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ABSTRACT

The Career Exploration/Industrial Arts program guide is based on experiences at two Oregon junior high schools. The program is unique in two respects: the learning is student-managed and the facility is a general open shop in which students plan and develop projects in a variety of activity areas. Student management consists of a notebook kept by each student of his activities and progress, allowing student experience in setting and achieving goals and in accounting for expenses. This system also saves many hours of recordkeeping for the instructor and provides for periodic assessment of students' work. Student-managed learning is reinforced through self-instruction when feasible. The open shop facility accommodates wood, metals, and drafting areas plus a range of other activities. Each activity area is self-contained with all tools, supplies, and instructional materials for the area. The open facility also increases opportunities for career exploration. The first third of the volume includes information on establishing such a facility by remodeling, new construction, and furnishing and installation. The second third consists of a series of worksheets for planning special projects. Appendixes, the last third, contain plan sheets for 10 basic project areas and student management system forms. (MF)

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DISTRICT NO. 8J

MARVIN L. EVANS
SUPERINTENDENT-CLERK

CAREER EXPLORATION/ INDUSTRIAL ARTS

(STUDENT MANAGED LEARNING)

An Adopter's Guide Referenced
in **Promising Practices**
in Oregon Education, 1975

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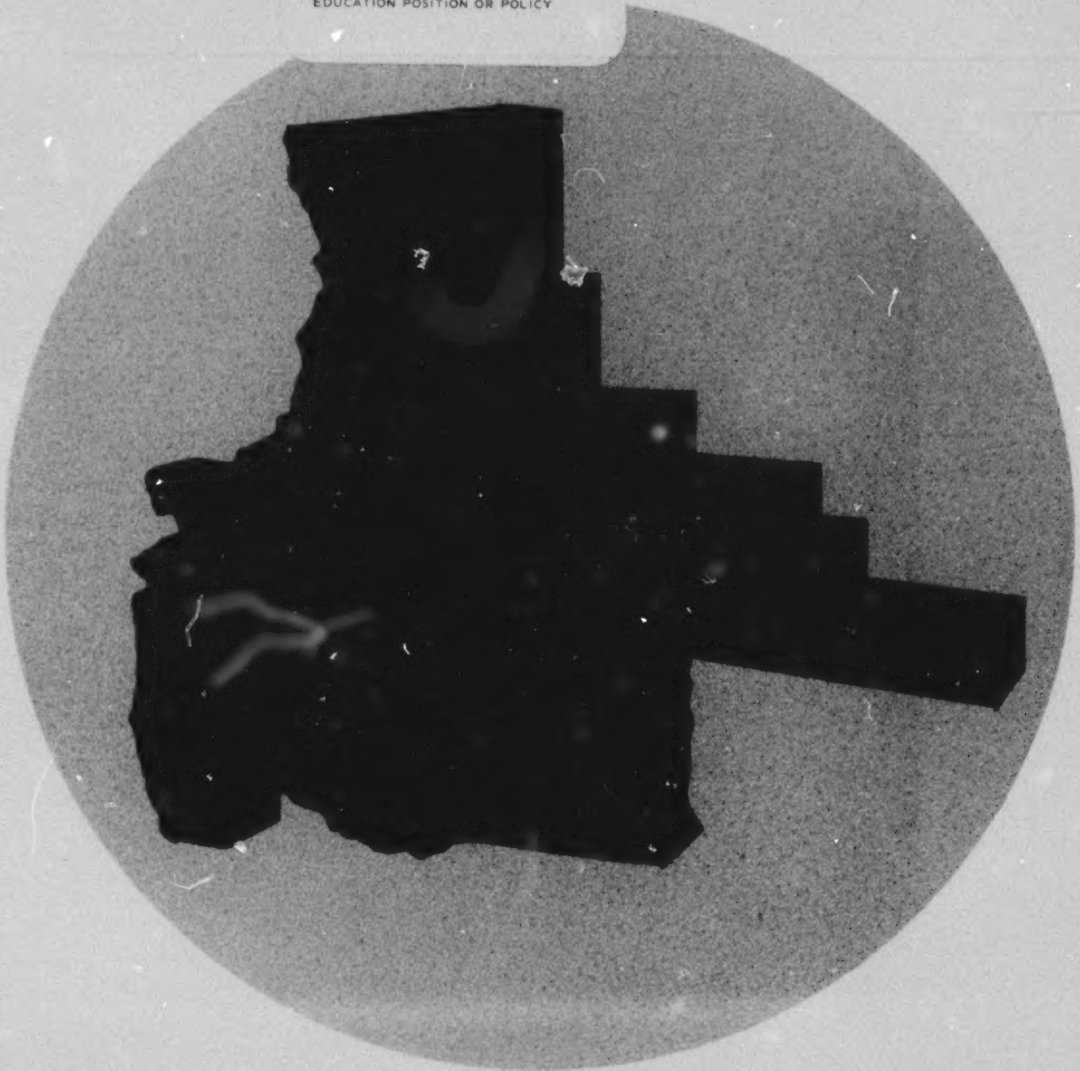

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FORWARD

To share information about how schools are solving their educational problems, the Oregon Department of Education has involved educators throughout the state in identifying instructional and management techniques that are innovative, effective and transportable. One of the ways these techniques are shared is through a catalog of Promising Practices in Oregon Education. Whenever promising or exemplary practices are developed with federal funds, the Department is encouraging the production of adopter's guides which will provide information for adopting districts.

This publication, which provides step-by-step directions for installing a student-managed learning program in career education and industrial arts, is another addition to the adopter's guide series.

Your comments and suggestions will help us improve future editions of this guide and others to be produced. Please take a moment to fill out and return the questionnaire which appears as the last sheet of this guide.

Jack E. Allen
Director
Exemplary Programs

CAREER EXPLORATION/INDUSTRIAL ARTS

(STUDENT MANAGED LEARNING)

This guide is based on experiences at the Pilot Butte Junior High School, Bend, Oregon, and the Calapooya Junior High School, Albany, Oregon. The Bend program began in 1972 and the Albany program a year later. Both projects were supported by Title III of the Elementary Secondary Education Act.

Career Exploration/Industrial Arts originated with a program known as "Occupational Versatility" developed in the Highline Public School District 401 and the Renton School District 403 in the State of Washington.

Development of the Career Exploration/Industrial Arts Program and this Adopter's Guide has resulted from the interest and dedication of a number of people.

Credit for designing and establishing the original program, known as Occupational Versatility, goes to John Lavender and Bill Guise. I had the opportunity to work with, and learn from, these two creative industrial arts instructors when I was a shop teacher at Keithley Junior High School, Franklin Pierce School District, in the State of Washington. These men have continued to share their wisdom with me as I have introduced the program in Oregon and, as part of that assignment, developed this guide.

Others in Washington State whose suggestions have found their way into the program and the guide are Gene Fowler, Carl Boe and Carl Steiger, Chinook Junior High School; and Gene Boggs and Martin Ulery, Keithley Junior High School.

The two pilot programs in Oregon have been at the Calapooya Junior High School in Albany and the Pilot Butte Junior High School in Bend. Calapooya staff members who have made valuable contributions to the program are Gene Freeman, Jim Abbott, Bill Schulz, Dean Robbins and Steve Kirkpatrick,(a student teacher, 1973-74). Pilot Butte staff members have been Larry Cathcart, Dennis Richardson, Bob Foote and Jeff Tuculet.

Another source of counsel and support has been Dr. Larry Kenneke, Industrial Education Department, Oregon State University.

Among my closest advisors have been the members of the program's steering committee. The committee has included two staff members of the Oregon Department of Education, John Fessant, Industrial Arts Specialist, and Jack Bech, Grants Operation and Review Specialist for Title III ESEA. Representing the Bend School District on the committee has been Orville Boyle, and the Albany Union High School District representatives have been Bob Stalick, Director of Instruction, and Jim Grossnicklaus, Career Education Coordinator.

Lee Blattner, Consultant
Career Exploration/Industrial Arts

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HOW TO USE THIS GUIDE

This guide is designed to help you:

- Become familiar with the Career Exploration/ Industrial Arts Program (Chapter I)
- Consider adopting the program at your school (Chapters II and III)
- Establish the facility to house the program (Chapter IV)
- Operate the program (Chapter V)

These first five chapters give you the information you need to plan, install, and operate your program. An additional chapter--Chapter VI--provides you with a set of worksheets. These worksheets, when completed, become the plan for your own Career Exploration/Industrial Arts Program.

The guide also includes a number of appended materials you will find useful.

We suggest that you proceed as follows:

- Page through the entire guide to become familiar with its organization and contents.
- Read more carefully the first five chapters, noting the suggested steps for planning and for furnishing the facility, and how the worksheets are to be used.
- Separate Chapter VI, the worksheets, from the rest of the guide (you may wish to put them into a separate notebook), and begin working through the guide with text and worksheets side by side.

Every effort has been made to design the guide to follow a logical sequence and make its use as convenient as possible. If you lack information at one point, go on and come back to that point later. You will find yourself working back and forth among the various parts of the guide, directed by your own circumstances as much as by the organization of the guide. The material has been printed in a looseleaf form so you can easily duplicate single pages and make revisions to meet your needs.

IN RETROSPECT

When we were in seventh grade, the girls enrolled in domestic science and the boys took manual training. The shop for manual training was in the basement next to the furnace room and domestic science was taught across the hall in a room painted pale yellow with curtains at the windows. Shop benches and sewing machines were row on row so students would face the instructor's desk at the front of the room.

The manual training instructor was Mr. Wells. He was a small man with a voice big enough to drown out an entire chorus of thirty giggling boys and the accompaniment of their hammers and saws. His badge of office was a ring of keys that hung from his belt like a ponderous sidearm. The keys opened everything that was worth anything: The school, the shop, his desk, his file cabinet, the storage room for lumber and materials, the metal bars that secured the hand tools to their racks on the walls, and the band saw.

The first period of the term was devoted to orientation. Mr. Wells lectured at length on the procedures for checking in and checking out, on safety and cleanliness, and on the necessity of proper "deportment". He conducted a tour of the shop, describing each of the hand tools and stationary power tools, both amusing and frightening his young charges with exaggerated demonstrations of the improper use of each. The tour was climaxed with a sermon on the horrors of the band saw that was so vivid with premonitions of severed arteries and cut fingers that awestruck students from that moment on would approach the band saw only when escourted by Mr. Wells.

One of the first projects of the year was to make a cutting board. Everyone made a cutting board. Only until the cutting board was completed to Mr. Welis' satisfaction could one proceed to the next project. The board was cut with a coping saw into the shape of a pig. A hole was drilled through the tail of the pig so it could be suspended, snout down, when not in use. Cutting out the pig was fun. But then came the tedious hours of sanding and finishing before it could be carried triumphantly home to an ever-appreciative mother who already had three cutting boards but was quick to say that she could always use another.

We learned a lot from Mr. Wells. He taught us the difference between a rip and a cross-cut saw and how to set the blade of a wood plane. But I'm glad I never had to use the band saw.

D.W.F.

I
THE PROGRAM

Career Exploration/Industrial Arts (Student Managed Learning) is a junior high or middle school program that is unique in two respects: The learning is student-managed, and the facility is an open, general shop in which students plan and develop projects in a number of activity areas.

The purpose is not only to increase the scope of industrial arts education in the sixth through tenth grades, but to help students learn more effectively.

The overall objective of the program is to develop "occupationally versatile" students who can:

- Work independently in the industrial arts facility, using available resources in a way that suits their desires and abilities;
- Be responsible to themselves and to the shop society in which they work;
- Be confident of their abilities, satisfied with their accomplishments, willing to be challenged, and capable of changing; and
- Consider their own futures and use available information to determine preferences about their futures.

The students achieve their objectives by selecting the activity area in which they want to work, select the project they want to produce, make the project and evaluate the results. Each student manages his other activities in the shop, including time utilization, learning mode, purchase of materials, project planning, facility maintenance and performance standards. Students instruct themselves in how to plan and in how to use tools, equipment, and materials. They investigate the career opportunities open to them and make judgments about these opportunities in light of their own interests and abilities.

The instructor is a learning facilitator and is responsible for counseling the student and creating the setting in which the student can learn. The setting, in turn, is designed to give every boy and girl the opportunity to move freely among the areas of activity and to have ready access to the tools and materials.

Outcomes of the student-managed learning approach to industrial arts are described in terms of five desired characteristics: When students have completed an experience in the shop, they will be:

- Knowledgeable - know about certain materials and processes;
- Skilled - able to accomplish a certain function or process to his or her own satisfaction;
- Adaptable - able to abandon old ways and acquire new ways of doing things;
- Productive - able to complete tasks;
- Self-sufficient - able to initiate and complete tasks with minimum direction or supervision.

The traditional industrial arts programs were concerned primarily with only the first two outcomes--acquiring knowledge and skills. Students were taught how to do things. Success was measured by how well they did them.

The occupational versatility, or student-managed learning, approach to industrial arts, however, is as concerned with how students learn as with what they learn. Students should be knowledgeable and skilled, but they should also be adaptable, productive and self-sufficient.

To be knowledgeable and skilled relates to the cognitive--the substance of what is learned. But substance is not enough. Students need to "learn how to learn" and how to make use of what they have learned. They need to acquire so-called affective outcomes: adaptable, productive and self-sufficient.

What are the observable characteristics of a learner who has become adaptable, productive, and self-sufficient? The developers of the occupational versatility approach have determined that there are seven:

1. Self-confident,
2. Competent in performing a task,
3. Cooperative in the shop,
4. Responsible to self and others,
5. Resourceful in solving problems,
6. Respects self and others,
7. Has pride in his or her work.

The affective outcomes--adaptable, productive, self-sufficient--are not easy to come by in the traditional shop where students are simply "taught". Students cannot as easily develop self-confidence, resourcefulness and other characteristics unless they are placed in a learning setting that is designed to foster these characteristics. That is why the setting for student-managed learning is an open, general shop; why the student management and self-instruction systems have been established; why the program is both ungraded and non-graded; why the program includes career exploration; and why the program is team taught. Each of these features of the program are discussed in more detail below.

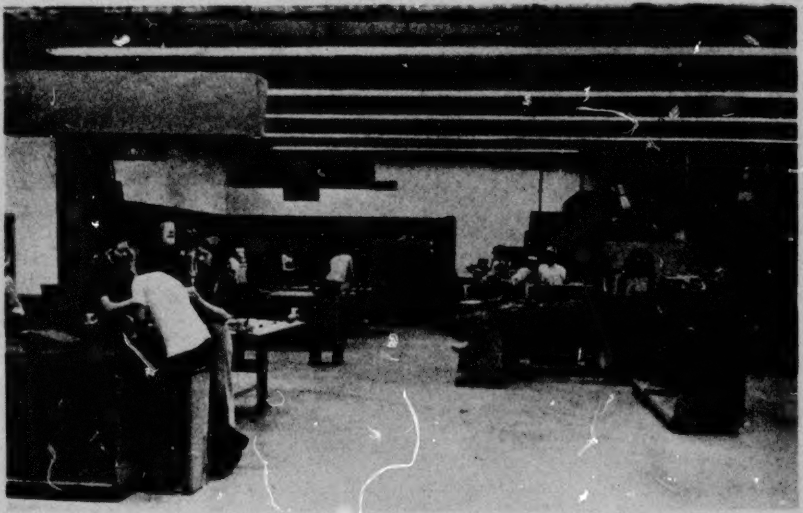
The Pilot Projects

The original concepts of the career exploration/industrial arts or occupational versatility programs have been tested in the Highline and Renton School Districts of Washington State since 1969. Industrial arts teachers were frustrated because more than half their time was spent in the paper work required to manage their facilities, and less than half their time was spent in teaching. Also, they wanted to develop a program that would motivate learning, that would meet a wide range of student interests, and that would help students explore the many careers that can be introduced to them by programs in industrial arts. A federal validation team gave these programs an extremely high rating in a 1973 visit to Washington State. The occupational versatility program was the only industrial arts program invited to the 1973 Education Fair sponsored by the U. S. Office of Education. Validation studies in Washington have been based on the program's potential exportability, its cost/effectiveness ratios, and its degree of innovativeness. These evaluations have led to the recommendation that career exploration/industrial arts (student managed learning) be replicated in Oregon school districts.

The first pilot program for Oregon was established in 1972 at the Pilot Butte Junior High School, Bend, with funds of Title III of the Elementary Secondary Education Act. The next year, Title III funds were used to establish a program at Calapooya Junior High School in Albany, As this guide is being written, additional programs are under way or planned for the Philomath Middle School (which will include art and home economics), Albany's Memorial and North Albany Junior High Schools, Parkrose Heights Junior High School near Portland, Fowler Junior High School in Tigard, and a new junior high school under construction at Oregon City.

A teacher station at the Poynter Middle School, Hillsboro, is using some of the student-managed learning procedures. Other schools are considering or are moving toward adopting the occupational versatility concept.

Evaluations of the Pilot Butte program were conducted in the 1972-73 and 1973-74 school years, and the Calapooya program was evaluated in 1973-74. (Occupational Versatility, 1973-74, Documentary File 8A, Northwestern Regional Education Laboratory, 710 S.W. Second Avenue, Portland, Oregon 97204)



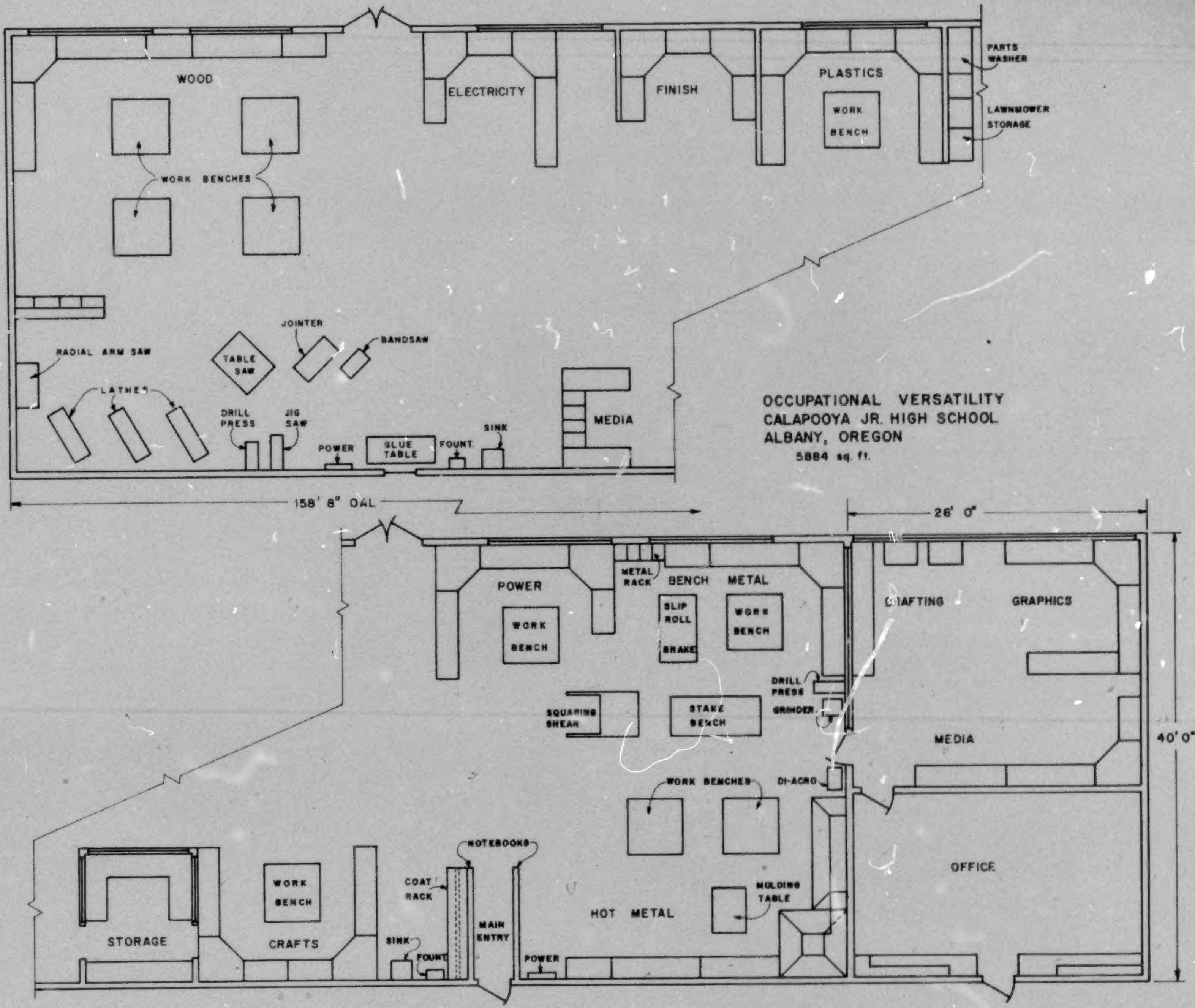
The Facility

Traditional industrial arts facilities of junior high and middle schools have been more than adequate in helping learners acquire knowledge and skills. But what about the other hoped-for outcomes of education--the adaptable, productive, self-sufficient student?

Developing these learner outcomes is facilitated, first of all, by creating one large, general shop (Figs. 1, 2). Walls that once separated wood, metals, and drafting areas have been removed. These activities now share a single room with a range of other activities that can include graphics, electricity, power mechanics, metals, plastics, hot metals and career planning.

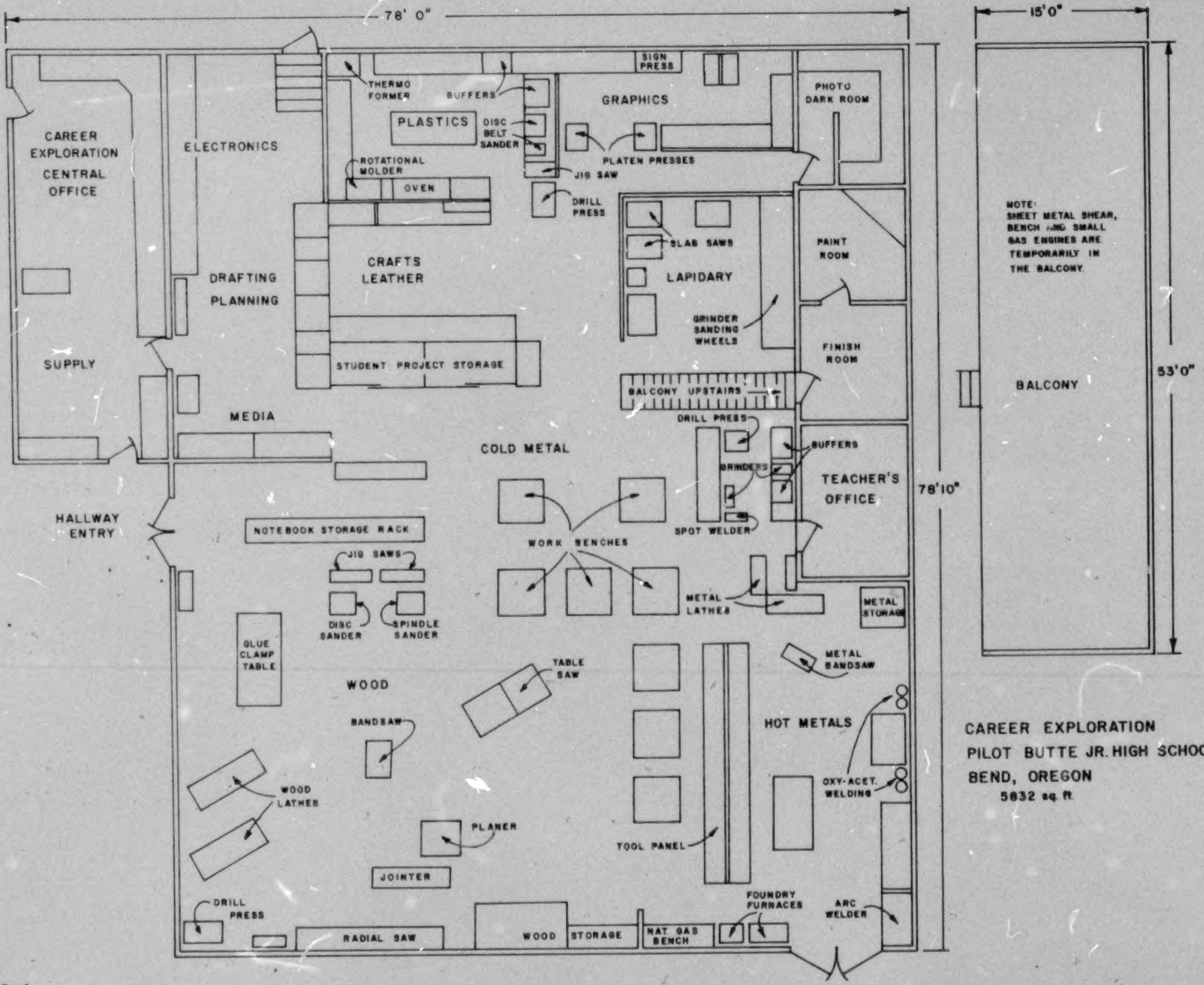
Each activity area is self-contained and is organized so that all tools, supplies, project samples, and instructional materials relating to the activity area are readily accessible to students.

The open facility exposes the student to a variety of activity areas, thus increasing the opportunities for career exploration. Ready access to materials and equipment helps students build self-confidence by assuming additional responsibility.



OCCUPATIONAL VERSATILITY
CALAPOOYA JR. HIGH SCHOOL
ALBANY, OREGON
5884 sq. ft.

WOOD
ELECTRICITY
FINISH
PLASTICS
WORK BENCH
PARTS WASHER
LAWNMOWER STORAGE
WORK BENCHES
JOINTER
BANDSAW
RADIAL ARM SAW
TABLE SAW
LATHES
DRILL PRESS
JIG SAW
POWER
GLUE TABLE
FOUNT.
SINK
MEDIA
158' 8" OAL
26' 0"
POWER
WORK BENCH
METAL RACK
BENCH METAL
SLIP ROLL
BRAKE
WORK BENCH
DRAFTING
GRAPHICS
DRILL PRESS
GRINDER
SQUARING SHEAR
STAKE BENCH
MEDIA
40' 0"
WORK BENCHES
DI-ACRO
STORAGE
WORK BENCH
CRAFTS
NOTEBOOKS
COAT RACK
SINK
FOUNT.
MAIN ENTRY
POWER
HOT METAL
MOLDING TABLE
OFFICE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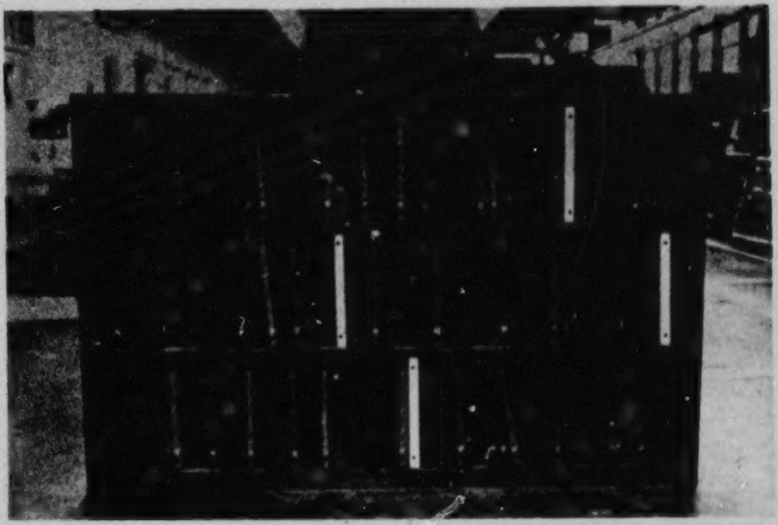
78'10"
53'0"
CAREER EXPLORATION CENTRAL OFFICE
SUPPLY
ELECTRONICS
DRAFTING PLANNING
MEDIA
HALLWAY ENTRY
THERMO FORMER
BUFFERS
SIGN PRESS
GRAPHICS
PHOTO DARK ROOM
PLASTICS
DISC BELT SANDER
ROTATIONAL MOLDER
OVEN
JIG SAW
PLATEN PRESSES
DRILL PRESS
CRAFTS LEATHER
STUDENT PROJECT STORAGE
SLAB SAWS
LAPIDARY
GRINDER SANDING WHEELS
PAINT ROOM
FINISH ROOM
BALCONY UPSTAIRS
DRILL PRESS
BUFFERS
GRINDERS
TEACHER'S OFFICE
SPOT WELDER
COLD METAL
WORK BENCHES
NOTEBOOK STORAGE RACK
JIG SAWS
DISC SANDER
SPINDLE SANDER
METAL LATHES
METAL STORAGE
GLUE CLAMP TABLE
WOOD
TABLE SAW
BANDSAW
METAL BANDSAW
HOT METALS
OXY-ACET. WELDING
WOOD LATHES
PLANER
TOOL PANEL
JOINTER
DRILL PRESS
RADIAL SAW
WOOD STORAGE
NAT GAS BENCH
FOUNDRY FURNACES
ARC WELDER
NOTE: SHEET METAL SHEAR, BENCH AND SMALL GAS ENGINES ARE TEMPORARILY IN THE BALCONY
BALCONY

CAREER EXPLORATION
PILOT BUTTE JR. HIGH SCHOOL
BEND, OREGON
5832 sq. ft.

FIGURE 2

What changes must be made in your industrial arts facility to accomodate a career exploration program? What specifications should be considered in designing a new facility that includes a career exploration/ industrial arts program? Facility planning is discussed in Chapter IV.



The Student Management System

The traditional shop is managed by the instructor. The Career Exploration Program is managed by students who achieve self-sufficiency by assuming responsibility for their own learning.

Each student is assigned a notebook. Notebooks are stored near the door and students pick them up as they enter and keep them at hand throughout the class period. Students are responsible for keeping records of:

1. Their attendance;

2. The materials they have purchased;

3. Their use of power equipment.

They also keep the record of their performance and use the notebook to store the sheets on which they have planned their projects.

The student management system is detailed in Chapter V.

The Self-Instruction System

Student managed learning is reinforced through self-instruction. Any process or procedure, and any tool or machine operation the student needs or wants to learn is explained through the self-instructional system established in the shop. The system includes instruction sheets, charts, audio tape cassettes, filmstrip-tape cassette combinations, and motion picture film loops. An important resource is other students, particularly older ones. And, of course, an instructor, or two or more instructors working in teams, are on hand as guides, coordinators and facilitators. Central to the self-instruction system are the "Basic 10's". These projects are discussed in more detail on page 52 and again on page 72.

It is important, however, that you chose your Basic 10's early in the planning process. The basic projects to be made by students determines the tools, the project materials, and the instructional materials they will need to complete the projects. Frequent references to Basic 10's will be made throughout the guide.

Ungraded and Nongraded Learning

Boys and girls, novices and veterans work together in a single class. A ninth grader and a seventh grader may start similar projects at the same time. This is ungraded learning.

Students receive course credit but no grades. This is nongraded learning. They maintain their own performance record to help them keep track of how they are doing in relation to their own expectations. This record can be shown to parents and counselors and can be used in planning the student's high school industrial arts program.

Both the ungraded and nongraded systems encourage individualized learning and cooperative learning among students. The systems also foster self-confidence since the goal is not a grade but a successful learning experience. The learning process is presented in more detail in Chapter V, "Operating the Program".

Career Exploration

In the early elementary grades, students develop an awareness of occupations and careers. As they reach junior high or middle school, awareness leads to exploration of "clusters" of occupations. Students enrolled in the Career Exploration/Industrial Arts Program have opportunities to actually experience activities related to one or more occupations; they get insights into what it's like to work with wood or hot metals, for example. These experiences serve as introductions to the world of work. They help students learn something about themselves, the range of occupations and careers, and how to make choices among occupations and prepare to enter a chosen line of work.

Goals for the Career Exploration Program at the Albany Union High School are presented in Appendix A. These may be useful as you set goals for your own program.

Team Teaching

A single, general shop with a number of activities provides an ideal setting for team teaching. Even though students are managing their own learning, the need for instructors to be readily available is not diminished. A large number of students involved in a variety of tasks in each of a number of activity areas is too great a load for one instructor.

The organization of a teaching team and an explanation of how the team can function effectively in a general shop is presented on page 80.

Should you decide that the Career Exploration/Industrial Arts (Student-Managed Learning) Program can be used at your school, you have at least three major resources to help you establish and operate the program:

1. This guide and worksheets;
2. Visits to established programs at other schools; and
3. Conferences with experienced teachers and consultants, including the state industrial arts specialist.

In addition, you will want to set a time line for establishing the program.

The Guide and Worksheets

The purpose of this guide is to explain the program and give you the information you will need to plan, establish and operate the program. Every effort has been made to give you the essential information you will need in a logical sequence. Included as part of the guide is a set of worksheets (see Chapter VI). The purpose of the worksheets is to help you plan your program. Throughout the text you will find references to the worksheets by number. The completed worksheets become your plan.

How to use the worksheets is explained on an introductory page that proceeds Worksheet 1.

Site Visits

The importance of visiting an established program cannot be overemphasized. Nothing beats the experience of being on the site and seeing the program operate. If you are troubled by time away from your own classroom and travel costs, remember that the expense of at least two site visits may be only a fraction of the total cost of adopting the program.

We suggest that you plan two visits:

1. An "awareness visit" that orients you to the program, and

2. A longer "planning visit" later on to gather detailed information.

As of July 1, 1975, Oregon's demonstration sites are:

1. Pilot Butte Junior High School
   1500 E. Penn, Bend 97001 (389-1122)

2. Calapooya Junior High School
   830 E. 24th, Albany 97321 (926-5581)

Current information on demonstration sites is available from the Industrial Arts Specialist, Oregon Department of Education, 942 Lancaster Drive N. E., Salem 97310.

These suggestions may help you make your visits more profitable:

- Allow yourself enough time to observe at least three full days of instruction;
- Put on a lab coat and get involved in the instructional process;
- Take pictures--they will help you remember space and construction details;
- Begin thinking about the Basic 10's and the information and instruction sheets you will use;
- Carry this guide, including your shop design (Chapter IV) and add your own notes to it.

Consultations, Conferences, Workshops

The Industrial Arts Specialist at the Oregon Department of Education should have the latest information on the student-managed learning program. If he doesn't have the answers he will know where to get them. As more and more industrial arts instructors have experience with the program, the number of potential sources of information will increase. In addition, plan to take advantage of conferences, workshops and university-level courses that relate to this approach to the teaching of industrial arts (Worksheet 14.2).

A Time Line

An important part of planning is to anticipate the time it will take to accomplish each step of the plan. Set a time line as soon as you can for establishing the program. The time line helps you determine what you need to do and when it must be done if the facility is to be ready for the first day of class. An example of the time line is presented on Worksheet 16.

The Career Exploration Program can be installed in phases if funds or resources are not available to complete the program in one year. One method of proceeding would be:

1st year - Remodel existing facility, Put in management system. Develop two or three activity areas.

2nd year - Add two more activity areas. Purchase self-instructional materials for the areas installed in first and second years.

3rd year - Develop remaining activity areas. Purchase needed self-instructional materials.

4th year - Review the program. Purchase needed equipment and self-instructional materials to complete the program.

Student Managed Learning Creed

The learner is responsible for the selection, direction, management and evaluation of his or her performance.

The educator is responsible to create the setting in which the learner can function and to provide counsel as necessary.

As the philosophy of the Career Exploration/Industrial Arts Program, this creed can guide the setting of student goals. On completion of the Program, students should be able to:

- Plan and manage their own shop activities independently of their instructor;
- Select the instructional materials they will use and develop their own procedures for completing the activity;
- Record their procedures and evaluate their own performance;
- Work effectively in at least three-quarters of the available areas (metals, woods, plastics, etc.);
- Investigate career opportunities and make judgments about them in light of their own abilities and interests.

Meeting District Goals

You may wish to compare the goals of your district with the goals of this program. Are they compatible? Would this program help the district meet its goals in career exploration and industrial arts? What changes, if any, would need to be made in this program to meet the district's goals?

The general goals and specific performance objectives of the Albany Career Exploration/Industrial Arts Program appear in Appendix A. It presents the performance objectives for each of the areas of the Albany program: Basic metalworking, graphic communications, power mechanics, woods, electricity/electronics, plastics, basic crafts (leather, copper, etc.)

and general industries (brick laying, concrete mixing, roofing, etc.). You may find these goals and objectives useful in planning your own program.

IV
ESTABLISHING THE FACILITY

Previous chapters have acquainted you with the purpose and scope of the Career Exploration/Industrial Arts (Student-Managed Learning) Program. You have made at least one visit to a school that has adopted the program. You have talked with your state industrial arts specialist, and have compared the goals of the program with those of your own district.

Now you are ready to establish the facility.

This chapter has three sections:

Section 1: Remodeling--for those who will remodel existing space to accomodate the new program.

Section 2: New construction--for those whose program will be housed in a new facility.

Section 3: Furnishing and installation--the casework, equipment, hand tools, and other materials needed to furnish the facility.

The objective of this chapter is to help you plan the construction and furnishing of your facility and estimate the costs. Operation of the program will be discussed in Chapter V.

If you are remodeling, proceed to Section 1. If you are planning new construction, turn to Section 2, page 38.

Section 1: Remodeling

Planning a facility that needs to be remodeled can follow this sequence:

1. Draw the perimeter of your present facility;
2. Review the general considerations to keep in mind in planning space to house a student-managed learning program;
3. Draw the perimeter of your proposed facility;
4. Determine the equipment and casework needed for each proposed activity;
5. Complete the floor plan of your proposed facility by pinning cutouts of needed equipment and casework to the drawing of the perimeter;
6. Determine the costs of remodeling.

If you complete each of the steps that begin on this page, you will have fulfilled the essential requirements for planning a facility that must first be remodeled. The steps are printed so that the text can be used as a checklist. References are made to appropriate worksheets.

( )___ Step 1

Draw your PRESENT shop floor plan. Refer to Fig. 3 (Phase 1), as an example. On a ¼" scale, draw only the perimeter of the shop as it exists today and include any walls that separate work and storage areas. Ignore for the moment cabinetry and stationary equipment that occupy space. The perimeter is what you have to work with; it's the shell in which you will install your new facility.

( )___ Step 2

Review the general considerations. Listed below are eight general considerations or principles to keep in mind as you proceed with planning:

(a) Be sure all areas of the facility are clearly visible to the instructor;

(b) Design a single room general shop that helps the student to:

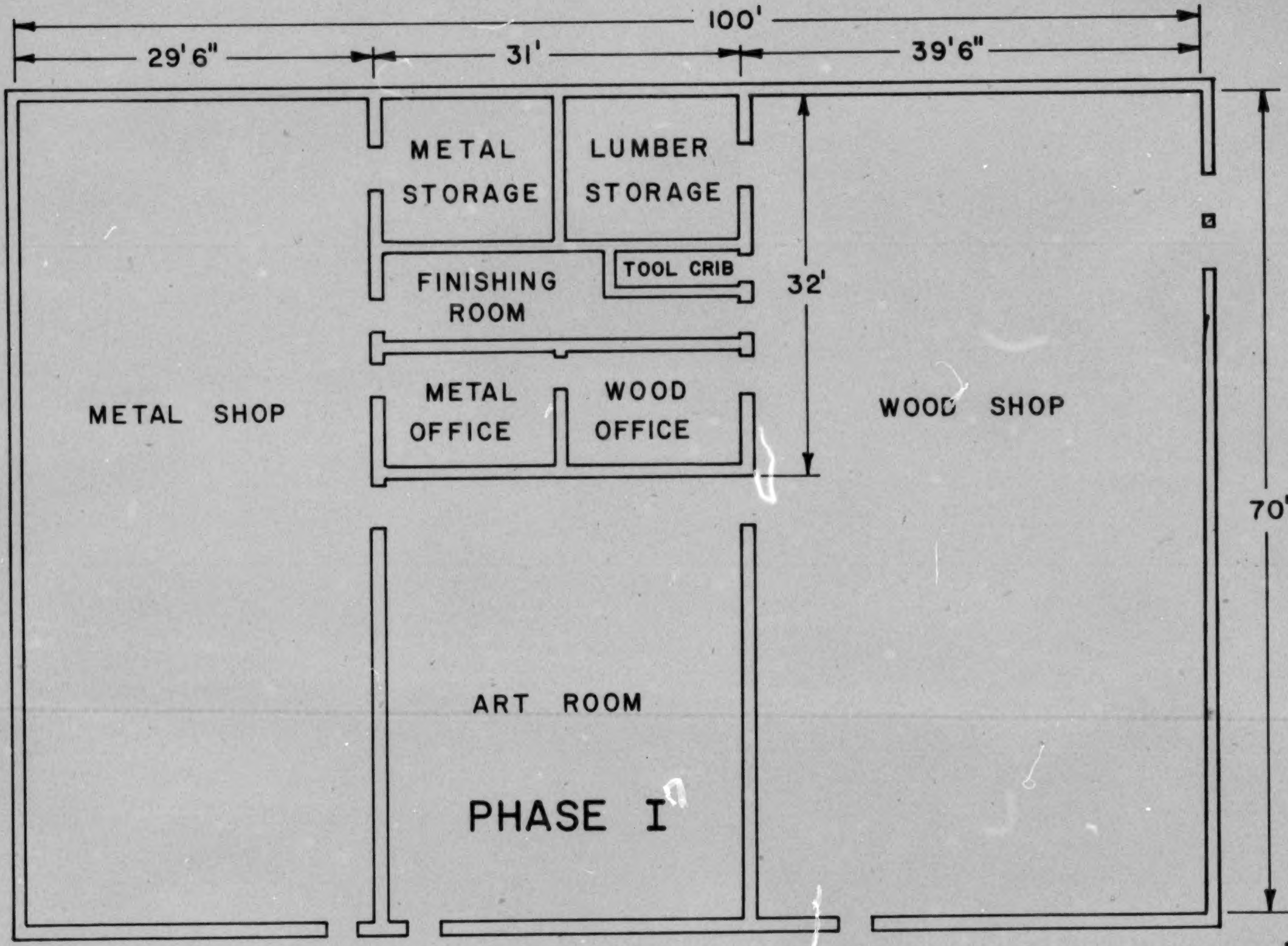

100'
29'6"
31'
39'6"
32'
70'
METAL SHOP
METAL STORAGE
LUMBER STORAGE
TOOL CRIB
FINISHING ROOM
METAL OFFICE
WOOD OFFICE
WOOD SHOP
ART ROOM
PHASE I

FIGURE 3

- Move freely and safely throughout the facility;

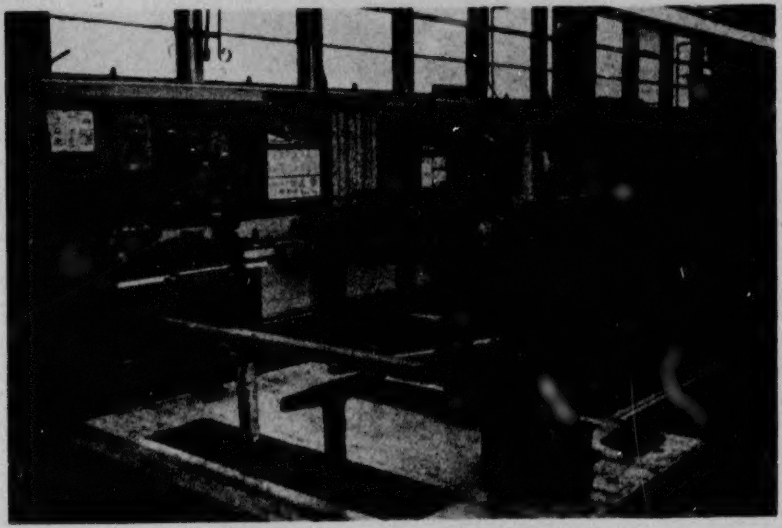
- Have ready access to the tools and equipment needed;

- Have ready access to the planning areas and to the instructional materials (media) and supplies needed; and

- Work in areas designed for the activity and designed to meet the student's needs.

(c) Plan compatibly located activities. Students work more efficiently when areas using the same equipment can be placed adjacent to each other or combined. Woods and plastics, for example, can use the same bandsaw, belt sander, and drill press. Those areas inclined to raise the most noise and dust are better off in their own corner of the shop. Planning areas should be quiet places but still convenient to work areas.

(d) Plan self-contained areas. In the traditional industrial arts setting, the student runs from work area to supply room to tool cabinet to reference materials and back to the work area again. Avoid lost time and increase productivity by placing materials, equipment, and instruction materials within a step or two of each work area.



(e) Plan open storage. Taking materials out of the back room and storing them on open shelves in the shop can pay off in the long run. Students cut materials as they need them. Experience in the Albany project shows that there is a greater recovery from the sale of shop supplies when students manage their own purchases from open storage than when supplies are managed by instructors. Open storage relieves the instructor of time-consuming clerical duties and takes less space.

(f) Isolate machine areas. Some shops are planned with work benches at one end, material storage at the other end, and machines in the middle. Materials are constantly being carried past machines in operation. Safety becomes a problem. Install machines out of traffic lanes and plan to reserve them only for machine operators.

(g) Provide adequate ventilation, effective dust control, and optimum light levels at work areas.

(h) Allow adequate space for the anticipated numbers of students. General specifications for planning are:

Work space per student - 75 square feet if facility remodeled, 100 square feet if new construction is planned.

Planning spaces - each station approximately 42" high for stand-up planning.

(NOTE: Chairs and stools are not needed and only take up space. Most activities are done best standing up.)

Draw your NEW shop floor plan. Refer to Fig. 4, (Phase 2). Now that you have in mind the general considerations for planning a remodeled facility, study the perimeter or shell of your present space. You want to design a single room, general shop. What non-bearing walls or sections of walls can be removed? What bearing walls and what other utility conduits and installations must stay in place?

( )___ Step 3

Check the feasibility of your plan. Now that you can be specific about the structural changes you need to make, ask district maintenance officials and others to check the feasibility of your plan. This is an important step.

( )___ Step 4

Visit a pilot program. This may be a good place in the planning sequence to visit one of the demonstration sites. You now know what can and what cannot be done to convert your own industrial arts space to accomodate student-managed learning. Refer back to page 13 for suggestions that may make your site visit more profitable.

( )___ Step 5

Determine the activities to be offered. Which activities to include in your new industrial arts program and how many to include are questions that relate to curriculum, budget, and available space. Your knowledge of the community and its interests and expectations will help resolve the questions from the standpoint of curriculum. But community interests must be reconciled to the realities of budget and space. Your ultimate choices, therefore, may be determined by the specific requirements of each activity under consideration. How much space is needed for hot metals, for example? What utilities are required?

( )___ Step 6

The characteristics and requirements of twelve activity areas are listed below.

A review of this information in light of space, budget and curriculum considerations may help you choose those activities to be included in your program.

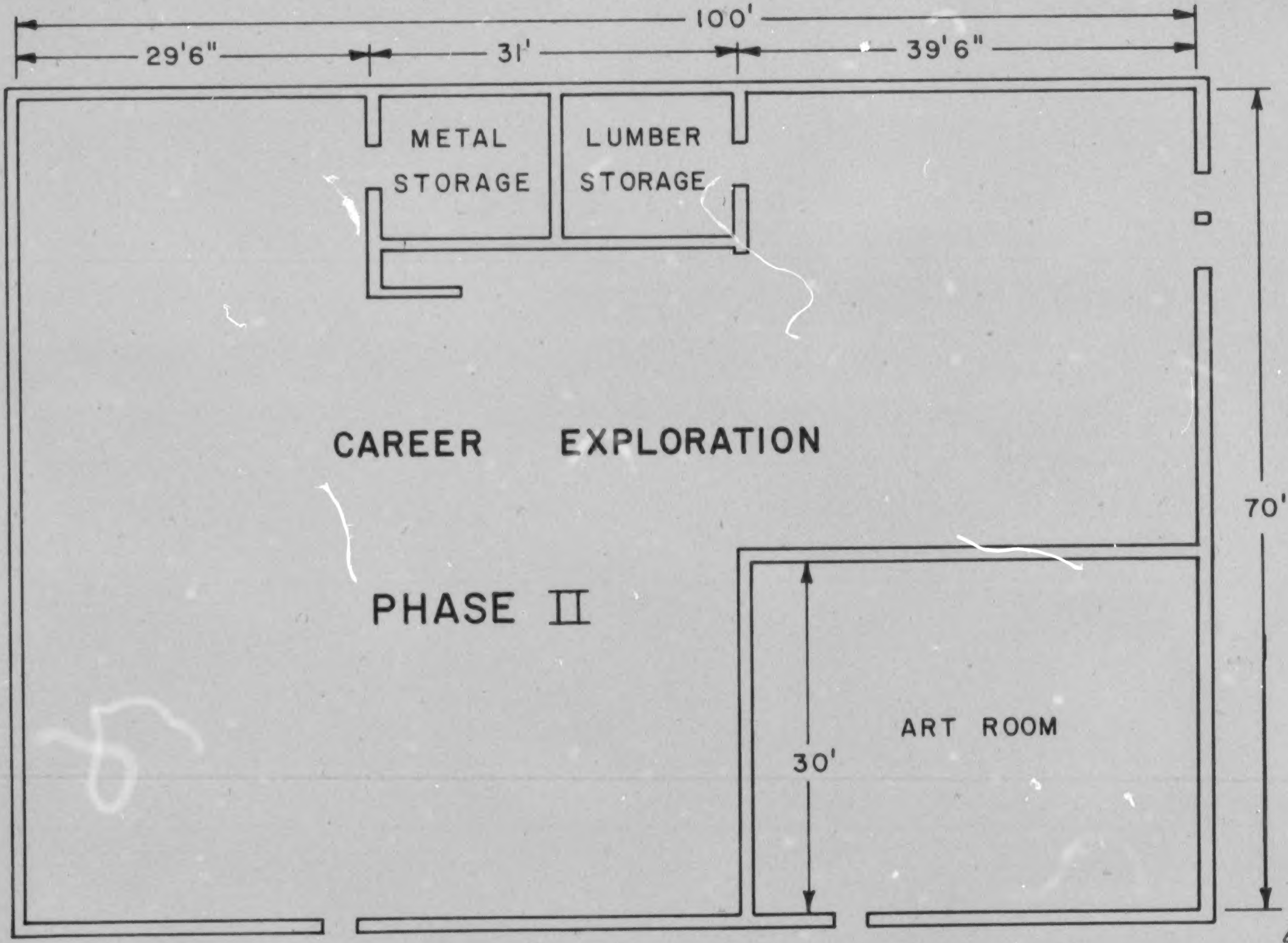
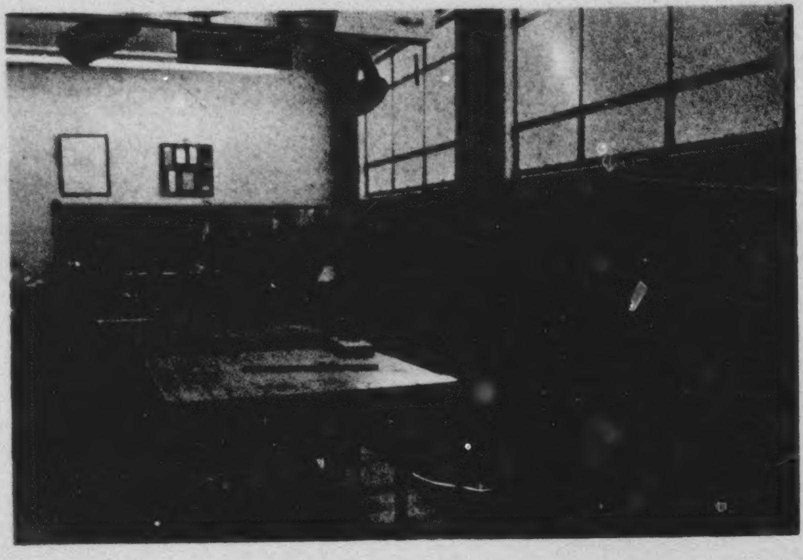

100'
29'6"
31'
39'6"
METAL STORAGE
LUMBER STORAGE
CAREER EXPLORATION
PHASE II
ART ROOM
30'
70'

FIGURE 4



Wood:

(a) Will likely draw more students than any other area;

(b) Requires a relatively large number of tools and equipment;

(c) Needs safety area for powered equipment including kickback area for tablesaw;

(d) Needs space for lumber and plywood storage;

(e) Needs space for large project storage;

(f) Tends to be noisy and dusty; requires ventilation and facility for collecting dust;

(g) Should be located near plastics and general industries areas for sharing common tools and equipment;

(h) Should be close to planning and finishing areas;

(i) Media board (tool panel), 24'. *

*Each activity area, except planning, will have a media board, or tool panel. See page 51 and Worksheet Series 10.

Cold Metal:

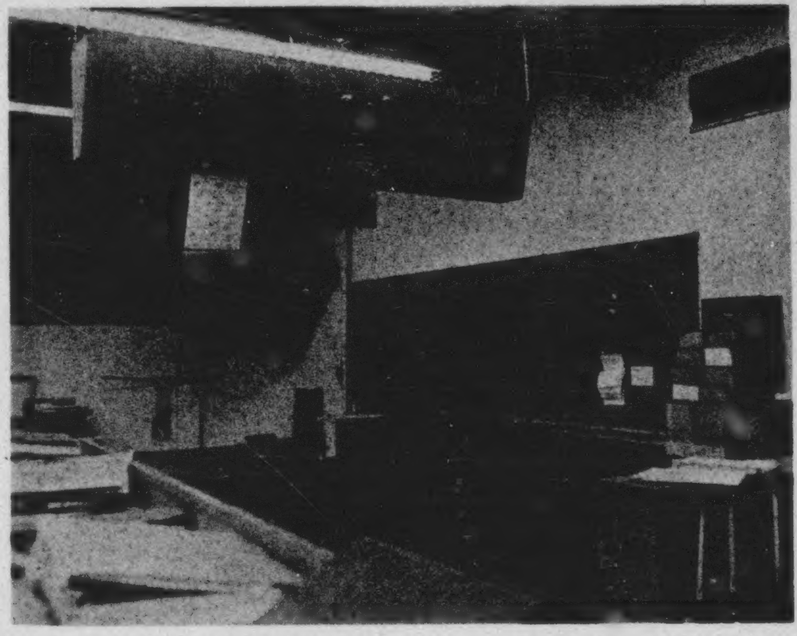
(a) Requires safety area for power hack saw;

(b) Needs relatively large area for media boards;

(c) Requires storage space for long stock and sheet stock;

(d) Should be located near planning and finishing areas;

(e) Media board, 16'.



Hot Metal:

(a) Is potential danger area; requires safety areas for equipment;

(b) Tends to be noisy and dusty, requiring ventilation;

(c) Requires hood to vent gases and heat;

(d) Requires foundry grate on floor;

(e) May have to meet local safety requirements for shielded wall at foundry;

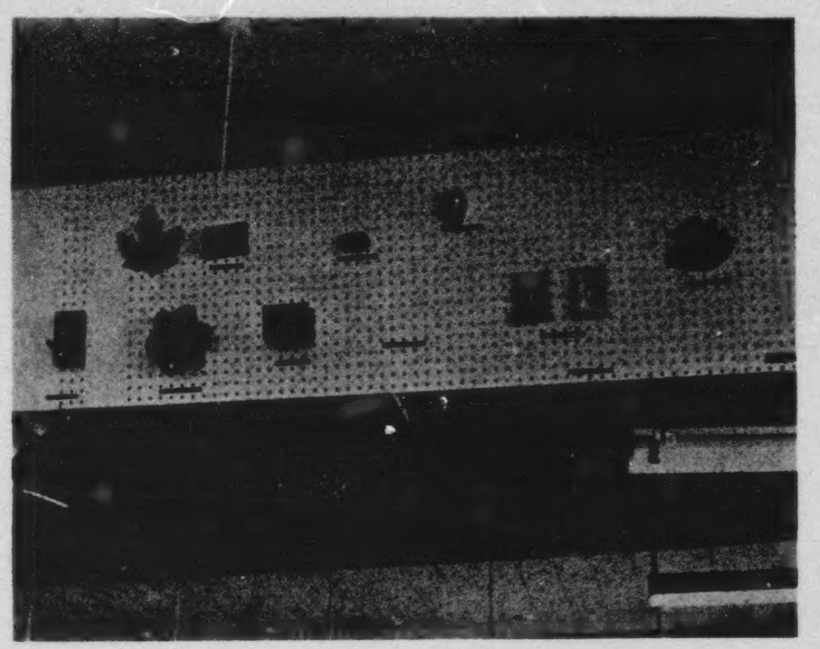
(f) Requires natural gas or propane for forge and foundry;

(g) Needs water for quenching;

(h) Needs 220 volts and snorkels for welders;

(i) Should be near cold metals area for sharing of common tools and equipment;

(j) Media board, 16'.



Plastics:

(a) May be another popular area;

(b) Should be well ventilated;

(c) May have to meet local safety requirements for hood;

(d) Needs exhaust facility for buffing machines;

(e) Requires holders for contaminates;

(f) Requires 220 volts for oven;

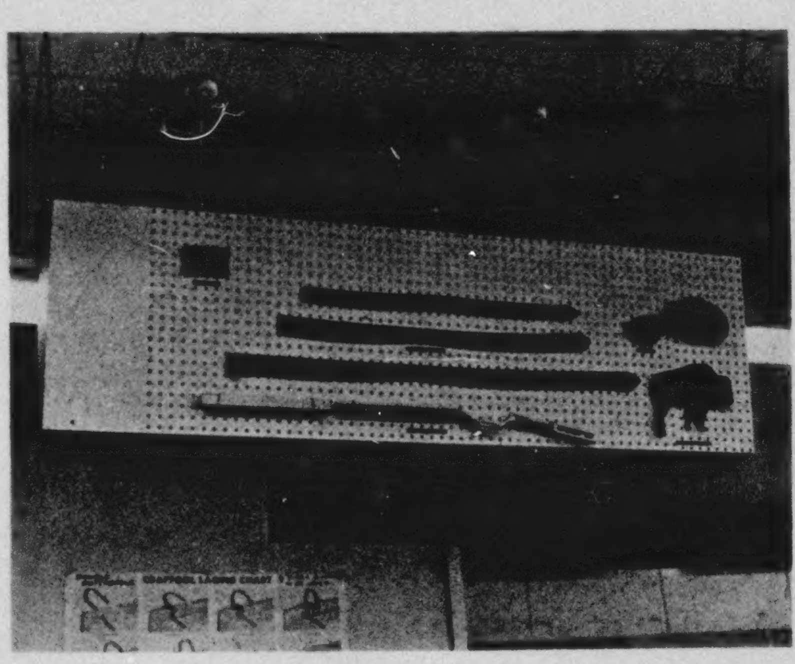
(g) Needs more electric circuits because of high amperage on plastics equipment;

(h) Needs water;

(i) Requires space for material storage;

(j) Should be located near finish area;

(k) Media board, 16'.



Crafts:

(a) Will attract a large number of students;

(b) Includes large number of activities;

(c) Requires storage for large amount of small tools;

(d) Also requires storage for small components;

(e) Considerable amount of prepared media is available;

(f) Should be located close to finish area;

(g) Media board, 16'.

Power Mechanics:

(a) Is another dirt and noise area;

(b) Should be located by outside door;

(c) Needs provision for engine exhaust;

(d) Needs washing tank for parts;

(e) Needs storage for engines and testing equipment;

(f) Needs containers for flammable materials;

(g) Media board, 12'.

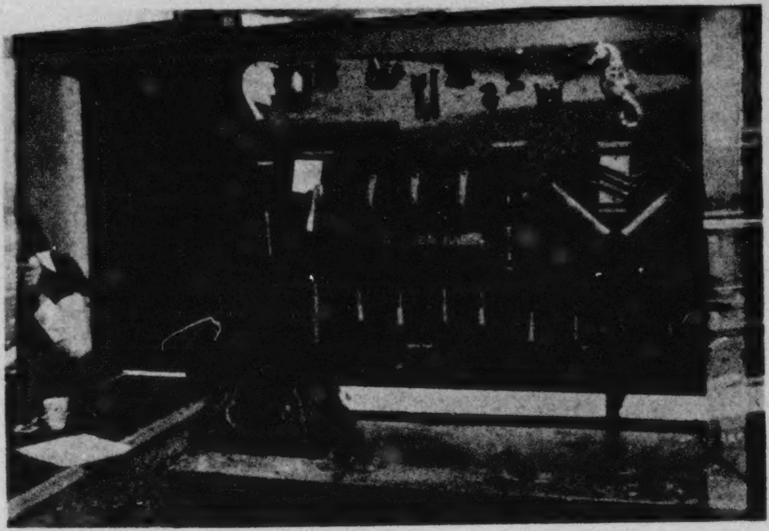
Graphics:

(a) Should be located away from dust and noise;

(b) Needs storage for paper and storage for drawing, drafting materials and equipment;

(c) Consider combining graphics with drafting and planning center, or at least locate near drafting and planning center;

(d) Media board, 16'.



General Industries:

(a) Water is needed for washing;

(b) Needs assembly space for mass production;

(c) Needs outside storage and large equipment storage;

(d) Can share tools and equipment with woods area;

(e) Media board, 16'.

Electricity/Electronics

(a) Another "clean area" activity;

(b) Needs little space;

(c) Requires storage for components and test equipment;

(d) Needs electrical outlets and grounding;

(e) Area for soldering is required;

(f) Plan for antenna;

(g) Media board, 8'.

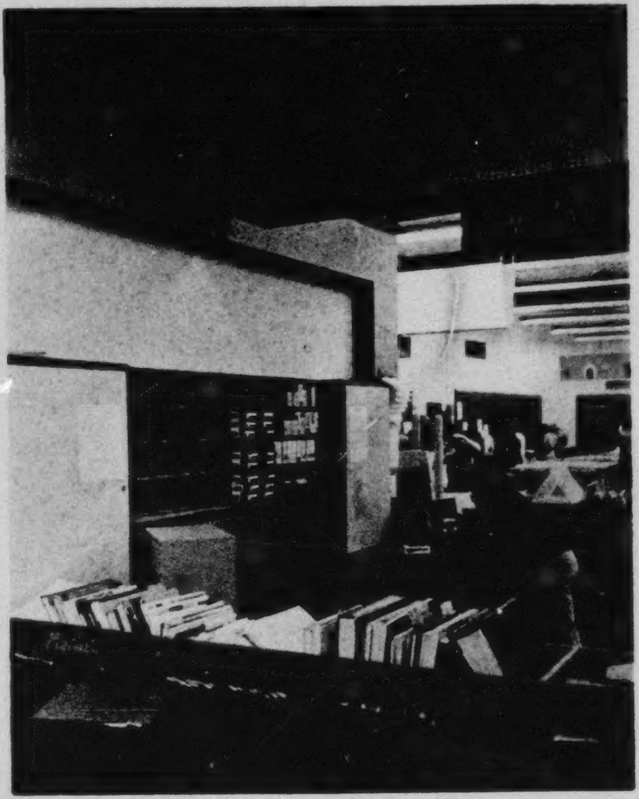
Drafting:

(a) Can be combined with planning activities in clean, quiet area;

(b) Provide for stand-up sketching cabinets;

(c) Needs area for displays;

(d) Media board, 8'.



Planning (Media):

(a) Locate for ready access to all activity areas;

(b) Requires 42" cabinet heights for stand-up planning;

(c) Needs electrical outlets for audio-visual equipment;

(d) Provide for film, tape and book storage.

Finish:

(a) Needs to be hooded and well ventilated;

(b) Requires good lighting;

(c) Provide storage for flammables;

(d) Needs water for cleanup;

(e) Locate away from electrical outlets or potential fire hazards;

(f) Needs to be close to woods, plastics, and craft areas;

(g) Media board, 16'.

( ) ___ Step 7

List the activities selected. Use Worksheet #1. The characteristics and requisites for each of the twelve activity areas have been presented on the preceding pages. Even though you may not have all the information you need to make a final decision, you can still make tentative judgments at this point about which activities to include in your facility.

To begin with, you will certainly need a planning (media) center if you wish to have a student-managed learning facility. High priority will be given to a finish area since it will be needed by the woods, plastics and crafts activities.

As for the other activities, you may have already concluded that woods is essential because of its universal appeal. This leaves metals, plastics, crafts, power mechanics, general industries, drafting, graphics, and electricity/electronics to be given a priority.

Turn now to Worksheet #1. The twelve suggested activity areas are listed. Space is provided for you to indicate which ones are essential, of high priority, and of lesser priority. You can be positive at this time about some choices and tentative about others. Later on, when you have more data, you can change your tentative choices. Meanwhile, you can proceed with your plans having some idea about the activities to be housed in your facility.

( ) ___ Step 8

Develop the floor plan--casework. Use Worksheets #2 and #5.

How much are you going to need in the way of casework--cabinets, tables, benches? In principle, the casework that you need is determined by the space that you have. In other words, it is unlikely that you will ever have more storage and work space than you need. So, make good use of the perimeter of your facility with casework.

Most of the cabinets and work surfaces are suited to every activity. Among the exceptions are storage cabinets for tubular metals, sheet metals, and wood. Keep your essential and priority activities in mind, but concentrate on making maximum use of available space. Plan also to make the best use of corners, recessed areas, hard-to-reach areas, etc.

Plan your casework needs as follows:

(a) Refer to worksheet series #2. These worksheets provide outline drawings of the casework. These are drawn to a ¼" scale for pinning to your new facility plan (Step b).

(b) Start clipping the drawings of the casework you will need and pin them to your facility plan. As suggested above, concentrate on making the best use of space, but keep in mind your tentative decisions regarding the activities your program will offer. Remember, too, that you must also allow space for stationary equipment. This will be considered in Step 9.

( ) ___ Step 9

Develop the floor plan--stationary equipment. Use Worksheet #3.

Your concern continues to be adequate space. Will you have room to house all the activities you hope to include in your program? In Step 8, you tentatively determined the casework you will need. Now, figure your stationary equipment. Stationary equipment is important at this point in the planning sequence because it, too, occupies space.

While casework is used for most activities, the equipment you will need is determined by the activities you consider essential and of high priority at this stage of planning (Worksheet 1).

Plan your stationary equipment needs as follows:

(a) Refer to Worksheet Series 3. Presented on this sheet are outline drawings of the equipment listed on Worksheet 7.

(b) Clip the drawings of the stationary equipment you will need and pin them to your new facility plan (Step 3). Here you begin to actually locate activity areas and apply the eight general planning principles of a single room general shop (Step 2). Remember to locate each activity area so it can be as compatible as possible with its neighbors. Allow for safe and convenient traffic patterns. Begin to think about proper venting, ventilation and access to utilities.

( )___ Step 10

Complete your floor plan. Refer to Fig. 5 (Phase 3). Hopefully, you have found space to accomodate all the activities you consider essential or of high priority. Before moving on to the next step, you may wish to double check two things:

(a) You will find on Worksheet 2.11 a miscellaneous category called "General Shop". Look through the "General Shop" items and clip any additional sinks, file cabinets, storage cabinets, waste cans, etc. that you may also need. These take space and should be pinned to your floor plan.

(b) You may have developed a floor plan that is somewhat different from the plan you originally had in mind. Does this new information affect earlier decisions relating to remodeling? For example, will you need more hoods than you anticipated? Will you need to make changes in water and gas lines or in electrical supply? It is important that these questions are answered to your satisfaction before computing costs.

( )___ Step 11

Determine the costs of remodeling. Use Worksheet Series 4. The next step in developing your plan for the use of a remodeled facility is to determine the costs of remodeling.

The costs to be determined are those that relate to structural changes; changes in the conduits, outlets, and fixtures for gas, water and electricity;

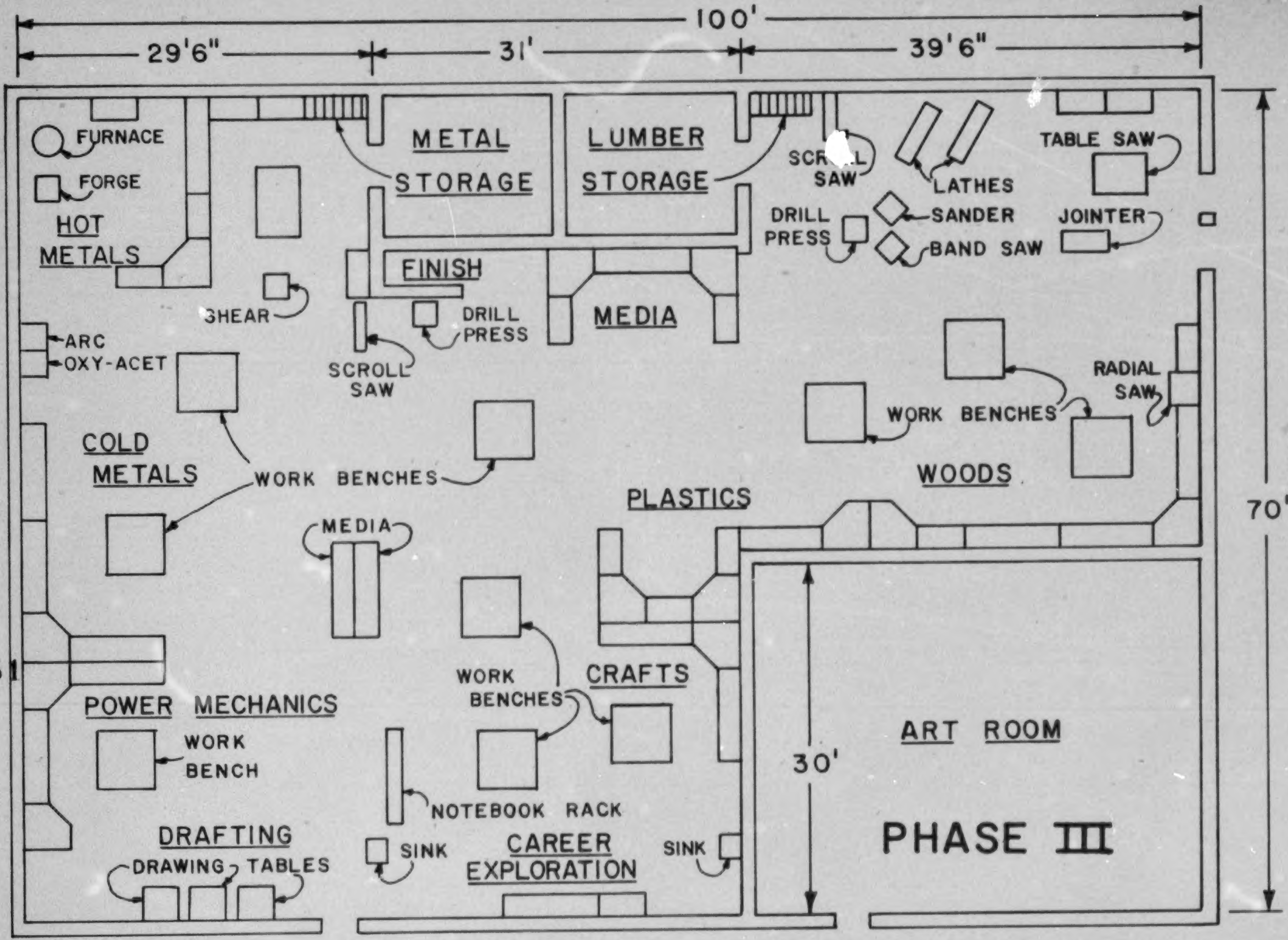

100'
29'6"
31'
39'6"
70'
30'
FURNACE
FORGE
HOT METALS
METAL STORAGE
LUMBER STORAGE
SCROLL SAW
LATHES
TABLE SAW
DRILL PRESS
SANDER
BAND SAW
JOINTER
FINISH
SHEAR
DRILL PRESS
MEDIA
ARC
OXY-ACET
SCROLL SAW
RADIAL SAW
WORK BENCHES
COLD METALS
WORK BENCHES
WOODS
PLASTICS
MEDIA
WORK BENCHES
CRAFTS
POWER MECHANICS
WORK BENCH
ART ROOM
NOTEBOOK RACK
PHASE III
DRAFTING
SINK
CAREER EXPLORATION
SINK
DRAWING TABLES

FIGURE 5

changes in the installation of hoods and other vents; and to painting, floor covering and installation of acoustic tile.

The costs do not include the casework and fixtures. These costs will be tallied later.

The cost of remodeling will be affected by who does the work: A commercial firm? District maintenance staff? Teaching staff? Teaching staff plus student labor?

Complete Worksheet 4; then move on to Section 3 "Finishing and Installation", page 48.

Section 2: New Construction

Planning a facility that will be housed in new construction can follow this sequence:

1. Review the general specifications to be considered by the architect in designing space to house a student-managed learning program in the industrial arts;
2. Review the general considerations for planning the use of this space;
3. Once you know the dimensions of the perimeter of your facility, draw this perimeter on a ¼" scale;
4. Determine the activities to be offered;
5. Determine the equipment and casework needed for each proposed activity;
6. Complete the floor plan of your proposed facility by pinning cutouts of needed equipment and casework to the drawing of the perimeter.

Complete each of the following nine steps. They are printed so that the text can be used as a checklist. References are made to appropriate worksheets.

( ) ___ Step 1

Review general specifications for new construction. At the time the architect is designing the perimeters of the space to be occupied by the student-managed learning program, these specifications should be noted:

(a) A rectangular-shaped area in which the width is approximately 2/3 the length;

(b) Minimum ceiling height of 12';

(c) Windows start from 7'6" from floor (or eliminate windows);

(d) At least 100 square feet of floor space per student;

(e) Large fold-up type door for deliveries;

(f) Alternate exits for emergencies;

(g) Non-skid floors

(h) Adequate lighting and ventilation

(i) Overhead dust collection adaptable to future changes

(j) Free-standing type casework to accomodate future changes

(k) Drop cord electrical power sources and continuous strip electrical wall outlets

(l) Locking-type power control panel (for safety and to avoid unauthorized use).

( )____ Step 2

Review the general considerations. Listed below are eight general considerations or principles to keep in mind as you proceed with planning:

(a) Be sure all areas of the facility are clearly visible to the instructor.

(b) Design a single room general shop that helps the student to:

- Move freely and safely throughout the facility;
- Have ready access to the tools and equipment needed;
- Have ready access to the planning areas and to the instructional materials (media) and supplies needed; and
- Work in areas designed for the activity and designed to meet the student's needs.

(c) Plan compatibly located activities. Students work more efficiently when areas using the same equipment can be placed adjacent to each other or combined. Woods and plastics, for example, can use the same bandsaw, belt sander, and drill press. Those areas inclined to raise the most noise and dust are better off in their own corner of the shop. Planning areas should be quiet places but still convenient to work areas.

(d) Plan self-contained areas. In the traditional industrial arts setting, the student runs from work area to supply room to tool cabinet to reference materials and back to the work area again. Avoid lost time and increase productivity by placing materials, equipment, and instruction materials within a step or two of each work area.

(e) Plan open storage. Taking materials out of the back room and storing them on open shelves in the shop can pay off in the long run. Students cut materials as they need them. Experience in the Albany project shows that there is a greater recovery from the sale of shop supplies when students manage their own purchases from open storage than when supplies are managed by instructors. Open storage relieves the instructor of time-consuming clerical duties and takes less space.

(f) Isolate machine areas. Some shops are planned with work benches at one end, material storage at the other end, and machines in the middle. Materials are constantly being carried past machines in operation. Safety becomes a problem. Install machines out of traffic lanes and plan to reserve them only for machine operators.

(g) Provide adequate ventilation, effective dust control, and optimum light levels at work areas.

(h) Allow adequate space for the anticipated numbers of students. General specifications for planning are:

Work space per student - 75 square feet if facility remodeled, 100 square feet if new construction is planned.

Planning spaces - each station approximately 42" high for stand-up planning.

(NOTE: Chairs and stools are not needed and only take up space. Most activities are done best standing up.)

Draw the perimeter of your proposed floor plan to scale. Once you have seen the blueprints of the new construction that will house your facility, make a copy of the plan on a ¼" scale. This will permit you to use the cutout drawings of stationary equipment and casework needed to complete Steps 7 and 8.

( ) Step 3

( )____Step 4

Visit a pilot program. Before proceeding with more detailed planning, you may wish to have another look at an established program. Refer back to page 13 for suggestions that may make your site visit more profitable.

( )____Step 5

Determine the activities to be offered. Which activities to include in your new industrial arts program and how many to include are questions that relate to curriculum, budget, and available space. Your knowledge of the community and its interests and expectations will help resolve the questions from the standpoint of curriculum. But community interests must be reconciled to the realities of budget and space. Your ultimate choices, therefore, may be determined by the specific requirements of each activity under consideration. How much space is needed for hot metals, for example? What utilities are required?

The characteristics and requirements of twelve activity areas are listed below.

A review of this information in light of space, budget and curriculum considerations may help you choose those activities to be included in your program.

Wood:

(a) Will likely draw more students than any other area;

(b) Requires a relatively large number of tools and equipment;

(c) Needs safety area for powered equipment including kickback area for tablesaw;

(d) Needs space for lumber and plywood storage;

(e) Needs space for large project storage;

(f) Tends to be noisy and dusty; requires ventilation and facility for collecting dust;

(g) Should be located near plastics and general industries areas for sharing common tools and equipment;

(h) Should be close to planning and finishing areas;

(i) Media board (tool panel), 24'. *

Cold Metal:

(a) Requires safety area for power hack saw;

(b) Needs relatively large area for media boards;

(c) Requires storage space for long stock and sheet stock;

(d) Should be located near planning and finishing areas;

(e) Media board, 16'.

Hot Metal:

(a) Is potential danger area; requires safety areas for equipment;

(b) Tends to be noisy and dusty, requiring ventilation;

(c) Requires hood to vent gases and heat;

(d) Requires foundry grate on floor;

(e) May have to meet local safety requirements for shielded wall at foundry;

(f) Requires natural gas or propane for forge and foundry;

(g) Needs water for quenching;

(h) Needs 220 volts and snorkels for welders;

(i) Should be near cold metals area for sharing of common tools and equipment;

(j) Media board, 16'.

Plastics:

(a) May be another popular area;

(b) Should be well ventilated;

---

*Each activity area, except planning, will have a media board, or tool panel. See page 51 and Worksheet Series 10.

(c) May have to meet local safety requirements for hood;

(d) Needs exhaust facility for buffing machines;

(e) Requires holders for contaminates;

(f) Requires 220 volts for oven;

(g) Needs more electric circuits because of high amperage on plastics equipment;

(h) Needs water;

(i) Requires space for material storage;

(j) Should be located near finish area;

(k) Media board, 16'.

Crafts:

(a) Will attract a large number of students;

(b) Includes large number of activities;

(c) Requires storage for large amount of small tools;

(d) Also requires storage for small components;

(e) Considerable amount of prepared media is available;

(f) Should be located close to finish area;

(g) Media board, 16'.

Power Mechanics:

(a) Is another dirt and noise area;

(b) Should be located by outside door;

(c) Needs provision for engine exhaust;

(d) Needs washing tank for parts;

(e) Needs storage for engines and testing equipment;

(f) Needs containers for flammable materials;

(g) Media board, 12'.

Graphics:

(a) Water is needed for washing;

(b) Needs assembly space for mass production;

(c) Needs outside storage and large equipment storage;

(d) Can share tools and equipment with woods area;

(e) Media board, 16'.

Electricity/Electronics

(a) Another "clean area" activity;

(b) Needs little space;

(c) Requires storage for components and test equipment;

(d) Needs electrical outlets and grounding;

(e) Area for soldering is required;

(f) Plan for antenna;

(g) Media baord, 8'.

Drafting:

(a) Can be combined with planning activities in clean, quiet area;

(b) Provide for stand-up sketching cabinets;

(c) Needs area for displays;

(d) Media board, 8'.

Planning (Media):

(a) Locate for ready access to all activity areas;

(b) Requires 42" cabinet heights for stand-up planning;

(c) Needs electrical outlets for audio-visual equipment;

(d) Provide for film, tape and book storage.

Finish:

(a) Needs to be hooded and well ventilated;

(b) Requires good lighting;

(c) Provide storage for flammables;

(d) Needs water for cleanup;

(e) Locate away from electrical outlets or potential fire hazards;

(f) Needs to be close to woods, plastics, and craft areas;

(g) Media board, 16'.

( )___Step 6

List the activities selected. Use Worksheet #1. The characteristics and requisites for each of the twelve activity areas have been presented on the preceding pages. Even though you may not have all the information you need to make a final decision, you can still make tentative judgments at this point about which activities to include in your facility.

To begin with, you will certainly need a planning (media) center if you wish to have a student-managed learning facility. High priority will be given to a finish area since it will be needed by the woods, plastics and crafts activities.

As for the other activities, you may have already concluded that woods is essential because of its universal appeal. This leaves metals, plastics, crafts, power mechanics, general industries, drafting, graphics, and electricity/electronics to be given a priority.

Turn now to Worksheet #1. The twelve suggested activity areas are listed. Space is provided for you to indicate which ones are essential, of high priority, and of lesser priority. You can be positive at this time about some choices and tentative about others. Later on, when you have more data, you can change your tentative choices. Meanwhile, you can proceed with your plans having some idea about the activities to be housed in your facility.

( ) ___ Step 7

Develop the floor plan--casework. Use Worksheets #2 and #5.

How much are you going to need in the way of casework--cabinets, tables, benches? In principle, the casework that you need is determined by the space that you have. In other words, it is unlikely that you will ever have more storage and work space than you need. So, make good use of the perimeter of your facility with casework.

Most of the cabinets and work surfaces are suited to every activity. Among the exceptions are storage cabinets for tubular metals, sheet metals, and wood. Keep your essential and priority activities in mind, but concentrate on making maximum use of available space. Plan also to make the best use of corners, recessed areas, hard-to-reach areas, etc.

Plan you casework needs as follows:

(a) Refer to Worksheet Series #2. These worksheets provide outline drawings of the casework. These are drawn to a ¼" scale for pinning to your new facility plan (Step b).

(b) Start clipping the drawings of the casework you will need and pin them to your facility plan. As suggested above, concentrate on making the best use of space, but keep in mind your tentative decisions regarding the activities your program will offer. Remember, too, that you must also allow space for stationary equipment. This will be considered in Step 8.

( ) ___ Step 8

Develop the floor plan--stationary equipment. Use Worksheet #3.

Your concern continues to be adequate space. Will you have room to house all the activities you hope to include in your program? In Step 7, you tentatively determined the casework you will need. Now, figure your stationary equipment. Stationary equipment is important at this point in the planning sequence because it, too, occupies space.

While casework is used for most activities, the equipment you will need is determined by the activities you consider essential and of high priority at this stage of planning (Worksheet 1).

Plan your stationary equipment needs as follows:

(a) Refer to Worksheet Series 3. Presented on this sheet are outline drawings of the equipment listed on Worksheet 7.

(b) Clip the drawings of the stationary equipment you will need and pin them to your new facility plan (Step 3). Here you begin to actually locate activity areas and apply the eight general planning principles of a single room general shop (Step 2). Remember to locate each activity area so it can be as compatible as possible with its neighbors. Allow for safe and convenient traffic patterns. Begin to think about proper venting, ventilation and access to utilities.

( )____Step 9

Complete the floor plan. Hopefully, you have found space to accommodate all of the activities you consider essential or of high priority. Before moving on, you may wish to double-check two things:

(a) You will find on Worksheet 2.11 a miscellaneous category called "General Shop". Look through the "General Shop" items and clip any additional sinks, file cabinets, storage cabinets, waste cans, etc., that you may also need. These take space and should be pinned to your floor plan.

(b) You may have developed to this point a floor plan that is somewhat different from the plan you originally had in mind. Would this new information alter decisions made with the architect regarding number and location of hoods, utilities, accesses, etc.? Any such loose ends need to be tied up before proceeding to the next section.

Section 3: Furnishing and Installation

Thus far in adopting a student-managed learning program, you have selected the activities to be offered and have developed a floor plan of the facility. If your facility is to be remodeled, you have an estimate of what the remodeling will cost. Whether you remodel or occupy new construction you have a plan for the "shell". Once the "shell" is finished, you are ready to move in.

This section of the guide takes you from the point that the space is ready for occupancy to the point that everything is in place and you are ready for the first day of class.

Considered in this section are:

1. Casework--purchasing, constructing, estimating costs;
2. Equipment and hand tools--purchasing, estimating costs;
3. Color coding--by activity area and for safety, estimating costs;
4. Student management system--materials, estimating costs;
5. Self-instructional system--instructional materials and equipment, estimating costs.

Your task now is to furnish the facility and estimate the costs.

The following sequence of steps can help you achieve these objectives.

( ) — Step 1

Determine the casework needs. Refer to Worksheet 5. You will find a list of standard-sized storage cabinets, tables, and benches used in most industrial arts facilities. Note the number of each item you may have on hand and the number you may need to buy or build.* Space is also provided to list odd-sized or special casework you will have to buy or build to fit into a particular space or meet a unique need.

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*It has been possible to contract with a commercial firm to design a student-managed learning facility and construct and install the needed casework. Information about these commercial services is available from the Industrial Arts Specialist, Oregon Department of Education.

( )___ Step 2

Purchase and/or construct casework. Use Worksheets 5 and 6. In the course of developing your floor plan you noted on Worksheet 5 the casework you had on hand and that which you will need to furnish your facility.

Refer again to Worksheet 5. Revise this list on the basis of any new information acquired since you completed it. Then proceed as follows:

(a) Determine the costs of purchasing the needed casework. Known vendors of cabinetry are listed on the appropriate worksheets. They will provide cost estimates on receipt of specifications.

(b) Determine the costs of building the needed casework yourself or arranging to have them built locally. Specifications for a number of standard casework items can be found in Worksheet 6.

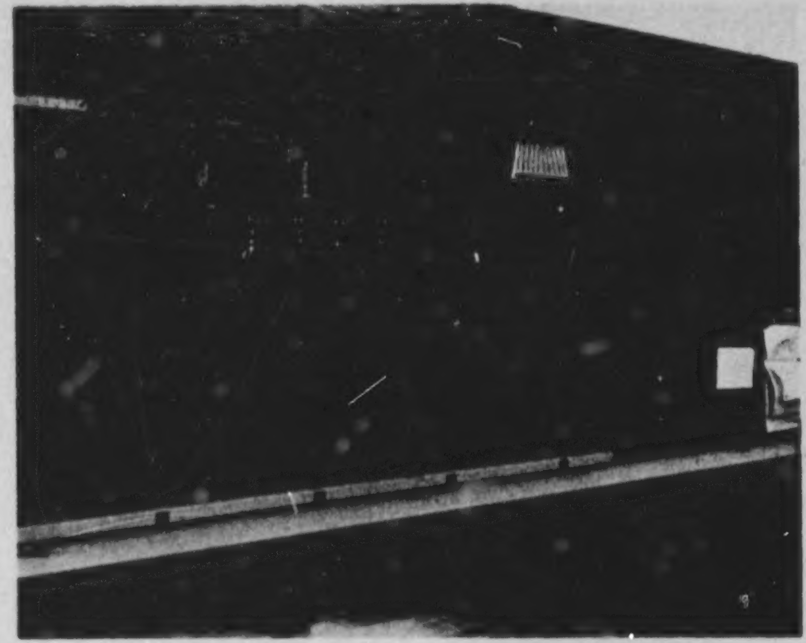
(c) Decide which of the two approaches is the most economical and then proceed to acquire the casework.

(d) Note the estimated cost of each item of casework you will procure.

(e) Complete Worksheets 5 and 6 by totaling all estimated costs. This total is the cost figure for casework.

( )___ Step 3

Determine stationary equipment needs. Refer to Worksheet Series 7. This worksheet presents the lists of equipment recommended for each activity area. Opposite each item are spaces in which you can note the number of that item you have on hand and the number you need to buy. Also included are the accessories that will have to be purchased for certain items of equipment. Hand tools are listed later (Worksheet 8) since hand tools are incidental to developing the floor plan.



Purchase hand tools. Use Worksheet Series 8. You have already inventoried the stationary equipment you have on hand (Worksheet 7) and estimated that which you will need for your facility. You developed this information in order to complete the floor plan. Now you need to inventory other equipment and hand tools you may have on hand to determine what you must purchase to completely outfit each activity area and serve your estimated number of students.

( )___ Step 4

Refer to Worksheet 8 and proceed as follows:

(a) Inventory other equipment and hand tools. The worksheet is organized by activity, so you will want to record your inventory on the worksheet by activity area to the extent that you can.

(b) Note the number of each item you will need to purchase in order for your facility to be properly and adequately equipped.

(c) Estimate the costs [illegible]urchasing equipment and tools.

(d) Total all estimated costs. This figure represents the cost of furnishing your facility with its needed equipment and hand tools.

( )___ Step 5

Install color coding. Use Worksheet Series 9. Once the casework and equipment are in place, they will need to be painted. Coding by color is an important aspect of a student-managed learning facility.

Color is used aesthetically to make the shop inviting and attractive. Color is also used functionally to identify the various areas of activity and parts of the machines.

Yellow, for example, is the color code for the wood area. Everything related to the woods activity--tools, panels, furniture fronts, instructional sheets, project ideas--are painted yellow, marked with yellow tabs, or printed on yellow paper. Blue is the color for cold metals, red for hot metals, pink for plastics, and so on.

The functional parts of every machine are color coded to help students quickly identify them. Green is the base color, orange the color for guards and switches, and yellow the color for controls.

Color coding helps establish an orderly and business-like shop. It helps students develop respect for materials and equipment and encourages them to return the portable items to their assigned racks and shelves.

Refer to Worksheet 9. The worksheet will help you determine the colors and types of paints you will need, estimate the amounts of each color, and figure the costs.

( )___ Step 6

Construct media boards. Use Worksheet 10. Worksheet Series 10 reviews the construction of media boards, or tool panels, These boards are considered "media" in that they not only provide support for tools but also offer space on which Basic 10's, charts, illustrations, and other materials can be displayed. Construction of the boards, support for the boards, and suggestions for the mounting of tools on the boards are included in Worksheet Series 10.

( )___ Step 7

Purchase materials for student management system. Use Worksheet Series 11.

The student management system was introduced on page 7 and is discussed in more detail in Chapter V. Now, however, identify and procure the materials you will need for the student management system.

Details for constructing the student notebook rack and for the "plug-in" boxes to hold the notebooks at the various activity areas are presented in Worksheets 11.10 and 11.11. The notebooks themselves need to be purchased, color-coded and numbered. The various forms to be inserted in each notebook must be purchased and duplicated.

Refer to Worksheet Series 11 and proceed as follows:

(a) Determine the number of notebooks you will need;

(b) Assign a color to each class period of the day (red, 1st period; white, 2nd period, etc.);

(c) Number sequentially the notebooks you will need for each class period;

(d) Determine the forms and the number of each form you will need. The forms are reproduced on the worksheet;

(e) Estimate the costs of buying and marking the notebooks and of producing and duplicating the forms;

(f) Estimate costs of constructing notebook rack and plug-in boxes.

Buy or build materials and equipment for the self-instruction system. Use Worksheet Series 12. ( ) ___ Step 8

Chapter V discusses operation of the self-instruction system and explains the various instructional materials that comprise the system. You need to give considerable thought to the self-instruction system at this point in your planning, however, because you will want to label and display many of these instructional materials, and store others so students can have ready access to them. And you will need to begin ordering audio-visual and print materials that you do not already have on hand.

We suggest that you begin with Worksheet 12 and complete each of the remaining worksheets in series 12. The worksheets are not in a prescribed order so you need not follow them sequentially. Each worksheet is self-explanatory.

As noted earlier (page 9), Basic 10's are central to the self-instruction system. It has been suggested that you select your Basic 10's early in the planning process because the projects to be made by the students determine what you must have on hand in the way of tools, project materials and instructional materials (media).

The Basic 10 is usually a relatively simple project that gives students their first opportunity to try their hand at a new activity (plastics, hot metals, etc.). If students are successful, they will have pride in their accomplishment and will feel good about working with different materials. You should plan at least ten basic projects for each activity area.

Once the new student has completed a Basic 10, he or she can proceed to a more extensive project. Even the Basic 10 can be modified to suit the student's needs and interests. He can make an exact copy of the Basic 10, he can develop his own version of it or he can take the fundamental idea of a Basic 10 and create his own project. Ideally, a student would develop a project of his own without reference to a Basic 10.

Refer to Worksheet 12.2. This worksheet discusses the building of Basic 10's and provides a means of estimating costs. Worksheet 12.3 explains the Basic 10 plan sheets, and suggests ways to mount the plan sheets for convenient student use. Specifications for building holders for displaying Basic 10 projects are presented in Worksheets 12.4 and 12.5.

Select your Basic 10's from examples included in Appendix B.

Signs identifying each activity area are useful and contribute to a business-like atmosphere. Information on constructing area signs is presented in Worksheet 12.6.

Price lists are posted in each activity area for students to use in estimating costs of their projects. Worksheet 12.7 refers to price lists.

Notebooks are prepared for each piece of power equipment in the shop. Students use these notebooks as guides to the operation and safety requirements of each unit. Equipment operation notebooks, the notebook sheets, and storage of the notebooks are considered in Worksheets 12.8, 12.9 and 12.10.

Equipment color coding and identification can be accomplished with instructions in Worksheets 12.11 and 12.12.

Film loops, film strips and audio-visual equipment are the subjects of Worksheets 12.13 through 12.17.

modern wood technology
CONTEMPORARY LAMPS
PORTABLE POWER TOOLS
PORTABLE POWER TOOLS
HAND WOODWORKING TOOLS

Purchase books and plan book storage. Use Worksheet Series 13. ( ) ___ Step 9

Books and other print materials are an important information resource. The worksheets in this series include lists of recommended texts and reference materials for each activity area. A worksheet for use in designing book storage is also included.

Estimate time for odds and ends. Use Worksheet Series 14. ( ) ___ Step 10

There are many odds and ends relating to the planning and installation of a Career Exploration/Industrial Arts program. Worksheet 14.1 suggests how to estimate and plan time for miscellaneous activities.

One activity worthy of consideration would be your own participation in a career exploration workshop. Information about such a workshop is presented in Worksheet 14.2.

( )___ Step 11

Compute the total estimated cost of finishing and installing your facility. Use Worksheet 15.

You come now to the step in which all the estimated costs and estimated times are summarized and a grand total is established. Most of the worksheets, you will recall, have spaces in which to note cost and time estimates. Transfer these estimates to Worksheet 15 and compute the subtotals for remodeling or new construction, and for furnishing and installing. The sum of these subtotals is the estimated cost of planning and installing the new program.

( )___ Step 12

Develop a time line. Use Worksheet Series 16.

A time line is a management tool that can help you organize your work and anticipate the time it will take you to accomplish a series of tasks. Worksheets 16 and 16.1 will help you establish your own time line.

Worksheet 16 charts a hypothetical planning sequence that begins in October and ends the following May. The activities to be accomplished within this period are represented by the worksheets of this guide. The numbers on the time line correspond to worksheets to be completed by a given time.

On Worksheet 16.1, insert the months during which you will be planning and installing your own facility. Then you list under the appropriate months the worksheets to be completed, using the suggested time line in Worksheet 16 as a guide.

Completion of Steps 1 through 12 ends the planning phase of your program. Installation follows, and then you are ready for the students to arrive and the program to get under way. Operation of the Career Exploration/Industrial Arts program is the subject of Chapter V.

V
OPERATING THE PROGRAM

Previous chapters emphasized planning and furnishing the facility. This chapter considers the actual operation of the program once everything is in place and the students have arrived for their first class period. The following narrative presents an overview of the program, documenting the steps a student takes from the moment he or she enters the shop until the first project has been completed. The narration provides background for a discussion that follows on class orientation, use of the inquiry method, and emphasis of career exploration. The student management and self-instruction systems are then discussed. The chapter ends with information on the role of the instructor and on organizing the teaching team.

An Overview: Jennifer Makes a Candleholder

Jennifer Wilson, an eighth grader, has enrolled in Career Exploration. The following narrative describes her experiences in the class. The narrative shows how the student management system would work under ideal conditions. But since no student would be as perfect--or as lucky--as our fictional Jennifer, you should keep in mind that the sequence of events in a real-life situation may not always conform to prescribed procedures.

A
THE FIRST DAY

Jennifer and her classmates spend the first two or three class periods getting acquainted with the program and with the shop. They see the activity areas and examples of projects that can be made in each. They learn about the notebooks and the forms that are kept in them. They become aware of the instructional materials and how they are used. They gain some insight into the concepts of student-managed learning. They become aware of the responsibilities they share with their instructors to make self-learning work.

B
SELECTING THE ACTIVITY AREA

Jennifer walks in the door the third day of the term and goes directly to the notebook rack. The notebooks for her period of the day are blue and Jennifer's number is 51. Notebook in hand, she goes first to the wood area. She had given some thought to making a pair of book ends. But the wood area is crowded with kids who seem to have the same idea, so she goes to the hot metals area. One of the Basic 10's on display in this area is a candleholder. She had noticed it on the tour of the shop the first day and it appealed to her. Her friend Linda wanders by. Linda still doesn't know what she is going to do, so they talk over a number of ideas. Linda leaves and Jennifer, after thinking about it for a few more minutes, decides she'll make the candleholder.

C
PLANNING THE PROJECT

Jennifer thumbs through the Basic 10 planning sheets filed at the hot metals area and finds the one that describes the candleholder. She opens her notebook to a plan sheet given her the first day and copies on to this sheet the procedures and specifications relating to the candle-holder: The tools and equipment needed, the procedures to follow, sources of information about the procedures, items to be entered in the bill of materials, and their cost.

Jennifer then goes to the school office (at a time other than during the class period) and gives the secretary $1.50. This covers the cost of the candleholder (90¢) and leaves enough in the "bank" for other projects. The secretary gives her a receipt.

As soon as she picks up her notebook for the next class period, Jennifer enters the $1.50 material payment (she also enters the 90¢ cost of the candleholder) on her materials cost record sheet. She then takes her notebook to one of the instructors. Mr. Walker initials her receipt (which she will take home), and he initials the $1.50 entry on the cost sheet. Mr. Walker then looks at her plan sheet and reviews with her the procedures she will follow. He also looks at the cost sheet to see that she has entered the 90¢ cost of the candleholder. He notes that Jennifer correctly completed her plan sheet for the candleholder and seems to understand what she is to do. He also notes that she failed to fill out her attendance and time utilization sheet at the close of the previous class period. Jennifer quickly makes the appropriate entries on this sheet. Mr. Walker initials her plan sheet and she hurries over to the hot metals area.

D
MAKING THE PROJECT

She first takes the material she needs from the open storage. Following the plan sheet, Jennifer proceeds step by step. A boy who made a candleholder when enrolled in the class last year and who is now working on a more extensive project, volunteers some information. Eventually, she comes to Step 8 on the plan sheet which calls for the use of the oxy-acetylene welder. Jennifer realizes that it is her responsibility to prepare herself to use this equipment. She studies the equipment operation notebook for the welder and goes to the media center to view a film loop that shows the welder being used. She watches other students using it. She examines the welder but doesn't turn it on.

Finally, Jennifer feels she's ready to try her hand at welding. She turns to the equipment operation check list in her notebook and notes in the spaces opposite oxy-acetylene welder the media she referred to while learning about the welder. She then asks Mr. Walker to check her out on the equipment. Mr. Walker asks her questions about procedures and safe operation of the equipment. He then observes as she performs the operations. Once he is satisfied that she can perform them correctly, Mr. Walker signs her equipment operation check list.

She is now checked out on the oxy-acetylene welder. Since this is one of the few pieces of equipment in the shop she cannot use without an instructor's permission, she must ask permission before each use of the welder.

Another period is ending. Jennifer takes her notebook from the plug-in box where she keeps it while working in the hot metals area, and completes the attendance and time utilization form for that day. For April 17 she writes, "Saw film on welder. Checked out on welder. Used welder." She also fills in the appropriate items on her student performance record form.

A few class periods later, Jennifer completes her candleholder. She fills in the project evaluation form in her notebook and calls on her instructor. Mr. Walker discusses the candleholder with her, pointing out how well she did for a first project in welding. But Jennifer asks for suggestions as to how she might do better next time. Mr. Walker responds, but is careful to help Jennifer make her own judgments. He also talks with her about how she feels about working with metals and with welding. At the close of the interview, Mr. Walker signs Jennifer's plan sheet. Her first project is completed, and she begins planning her second.

A summary of the procedures that students and teachers follow in the operation of the program is presented in Table 1.

Orienting the Class

What takes place the first few days of a new program can help determine how well it runs and the number of problems that may occur. Allow enough time for adequate planning. Orientation should last at least three days if not longer. Your procedures will change the second year because you will have continuing as well as new students mixed together. But class orientation should be easier the second year because of the help of your returning students.

The following topics should be covered during class orientation:

1. Explain to students what will be expected of them in the new program,
2. Show students the facility and explain the different components,

3. Go over the notebook forms and their uses;
4. Explain how to start a project and introduce the Basic 10's;
5. Assign alphabetized notebooks after you are sure of your enrollment in each class;
6. Explain the method of taking role and the system for cleaning up.

If orientation is taking too long, let the students begin planning their first project and then return to the orientation later.

If procedures break down, and it appears that students may be at fault, convene the class and call for suggestions from the students. Remind the students that the shop belongs to them as much as it does to the instructors, and that they share the responsibility of assuring that the facility runs smoothly and that learning takes place.

Inquiry Method

The teacher's role is to create the setting for learning and not direct the learning. If learning is to take place, the teacher must guide students into finding information on their own. A self-sufficient student doesn't always run to the teacher for answers.

Teachers use the inquiry method to help students find answers to problems. In simple terms, teachers answer a question with a question. This method does not take the problem away from the student. It facilitates learning but does not direct it. The inquiry method is referred to in Table 1.

TABLE 1

PROCEDURES FOLLOWED BY STUDENTS AND TEACHERS IN THE OPERATION OF THE PROGRAM

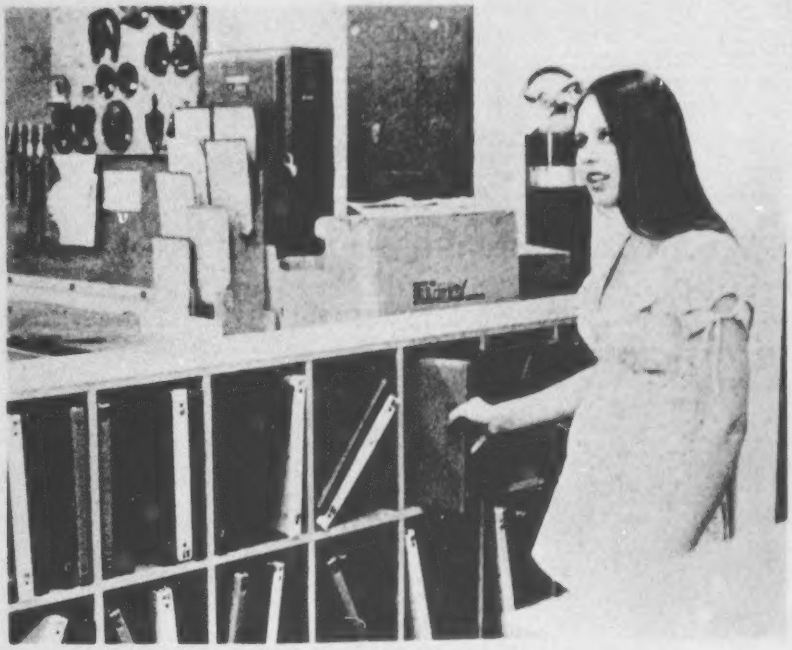
	STUDENT PROCEDURE	FACILITATION	TEACHER PROCEDURE
	Select an activity area.	Activity areas in woods, metals, plastics, power graphics, electricity/electronics, drawing, general industries, etc. Designed projects and examples in every area. References available for other ideas. Student is encouraged to design his own project.	The selection is the student's problem and responsibility. An initial time allowance must be given for the student to make his selection independently (3-5 days). Then if the student is still looking, the teacher should say, "Why don't you and I walk around together and look for ideas." The teacher then may explain some of the options. If there is further delay in area selection (2-3 days), the teacher will discuss the student's responsibilities with the student. Assignment at this time may become necessary.
	Develop a plan anc procedure for operation.	Student management system including time utilization, material purchases, planning records, machine operation records, performance records and self-evaluation.	Sample projects are displayed and planned in every area. If a student selects one of these, the provided directions must be basic. The student, in working on these projects, must be allowed time to demonstrate adaptability in following the step by step procedures. If the teacher feels the student has exhausted all resources, he may assist but in an inquiry approach and may be more directive if it is necessary to insure a successful experience for the student. If the student is developing a plan of his own, the teacher should counsel him in the design and planning steps, but again in an inquiry manner. Whenever possible, refer him to resources. DO NOT TAKE THE PROBLEM AWAY FROM THE STUDENT.
	Instruct self in the processes and operations required.	Self instructional materials including film, tapes, instruction sheets, etc. for all processes and operations.	The "mode of operation" that a student uses is his responsibility. Various alternatives are provided for him. The teacher again will support his process as explained previously in regard to the developing of a plan and procedure.
	Manufacture the item.	A well equipped, maintained and safe general shop.	The student's activities are observed by the teacher at all times. If the student is about to engage in an unsafe practice, or one that will ruin his material, the teacher must intercede immediately. The method used here (direct or inquiry) will have to be determined by the urgency of the situation. To assist in the continual improvement of the student's operations is the teacher's responsibility. When a student is operating a machine or doing a process, the teacher should help improve the student's techniques. Use the inquiry method whenever possible.
	Explore careers.	Student Performance record for careers with over 60 career activities. Require media to complete each activity.	On his plan sheet the student will write out and complete the career activity he has selected. The student will record his career activity on his career performance record. A student, upon completion of his project, will have his career activity checked by an instructor.
	Evaluate the results.	Student satisfaction index.	A student upon completion of a project, has the opportunity to look at his work in terms of his satisfaction as to how well he did. He may fill out a form titled "Student Satisfaction Index". A teacher may complete a comparable form as to how well he feels the student did. This way, both student and teacher may then have a conference in regard to the student's feelings and accomplishments. Both student and teacher enter the conference with judgments and then an evaluative session can take place.

Exploring Careers

As they talked about the completed candleholder, Mr. Walker said to Jennifer, "You seem to feel pretty good about the candleholder, and are anxious to show it to your folks. But how did you feel about working with the metal and the welder and all the other materials and processes that went into making this item?" Jennifer thought a moment. "Well, it was okay, I guess. It's kind of hot and dirty. But I suppose it's what you have to do if you want to make something out of metal." Mr. Walker was asking a leading question to help Jennifer verbalize her feelings about working with metals. This is a technique of the inquiry method discussed above. This particular method represents the essence of career exploration at the junior high and middle school levels. Students are encouraged to ask themselves: "How do I feel about working with metals (woods, plastics, fabric, etc.)? Do I like working with the materials and equipment that are used to shape metals into things I want to make?"

The emphasis at this stage of the student's development is more on the activity than on the career. The students' explorations in the shop lead them to the development of definite feelings--positive, neutral, negative--relating to an area of activity and all that goes on in the pursuit of that activity. Later on, the student will begin to associate areas of activities with particular job descriptions. If he or she enjoyed working with wood, for example, the student will be motivated to think more about carpentry, furniture manufacturing, forest products industries, and the full range of vocations relating to the production and use of wood. Or, as in Jennifer's case, the student may decide that metalwork isn't as much fun as other things, and will be less likely to give any thought to metalworkers and what they do.

The thrust of career exploration/industrial arts for sixth to ninth graders, therefore, is to encourage each student to experience a variety of activity areas. Instructors look through the notebooks and take every opportunity to talk with students about their projects. Every effort is made to fulfill the "exploration" goal of the program: "To work effectively in at least three-quarters of the available areas."



The Student Management System

A
PURPOSE

The student management system is essentially the notebook and the various orientation and record sheets the student keeps in the notebook to guide his activities and record his progress (Worksheet 11).

The student management system allows the student to experience keeping records and accounting for expenses. It also gives students what may be their first experience in setting goals and judging the extent of their progress toward achieving those goals.

From the instructor's point of view, the system saves countless hours of record-keeping. Each notebook provides up-to-date indicators for assessing each student's progress. Periodic reviews are made of each notebook so that instructors can be alerted to those students in need of extra help.

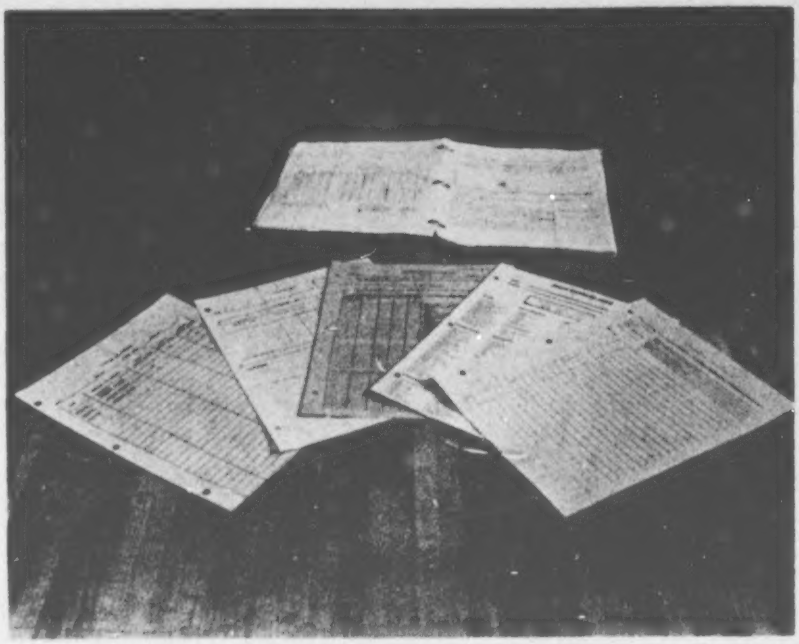
B
OPERATION

On the roster of students enrolled in career exploration, Jennifer Wilson is student number 51. She is enrolled in the third class period of the day which is assigned the color blue. So Jennifer's notebook is blue and has the number 51 printed on its spine.

When Jennifer arrives for class, she goes first to the notebook rack where the blue notebooks are stored, pulls number 51 and goes to her work area. Whoever keeps roll for the period notes the absentees by recording the numbers of the notebooks that remain in the notebook rack after the class has started.

At the work area, Jennifer and her classmates keep their notebooks in plug-in boxes (Worksheet 11.11). Notebooks are off the work surfaces and out of the way, but are still close at hand during the class period. Entries can be made on the spot before they are forgotten. Answers to questions of procedure are immediately available. The notebook can be a reference point in consultations with the instructor.

When the period ends, Jennifer returns her notebook to the notebook rack. Students do not take their notebooks out of the shop.



C
STUDENT MANAGEMENT
FORMS

Out of the experiences of the pilot projects have come a series of eight forms to be used in the student management system (Worksheet Series 11). The uses of each form are explained below. The forms themselves are presented in Appendix C. You may make your own copies of the forms by duplicating these examples. Study them carefully before reproducing them; you may wish to revise them to meet the needs of your own setting and, possibly, add other forms to the series. Following a presentation of all the forms, you will find a discussion of how to assess the forms as you review student notebooks.

These are student management forms:

Attendance and Time Utilization Record (Worksheet 11.2). The student uses this sheet to log his activities during the term. It is made up as a calendar with a line for each school day. Using prescribed notations, the student notes the days he or she is present and records briefly what he did that period. A principle of the student-managed learning system is that the student is responsible to himself for what he does in the shop. He exercises that responsibility by using the attendance and time utilization record.

Student Performance Record (Worksheet 11.3). On this form, students record their accomplishments in the shop. The front side of the sheet lists all the potential operations in the facility. When students complete an operation (grinder, oil finish, hemming, etc.) they fill in the circle preceding the name of the operation on the sheet.

This form is also used as a guidance tool to encourage students to explore all activity areas. A quick look at the front of the form shows the activity areas already explored by the student. Little evidence of exploration alerts the instructor to counsel the student to try other activity areas.

On the back side of this record are a series of questions designed to reinforce the values the staff feels are important, which relate to program objectives. The purpose of these guidance questions is to have students respond in a subjective manner; the questions are tools to be used in guiding and redirecting their activities.

These judgments are made periodically during the year. The form becomes a quantitative and subjective evaluation. A qualitative evaluation takes place on completion of each major activity. See Student Evaluation Sheet (Worksheet 11.7).

A copy of the performance record is sent home at the end of each quarter so parents can see the progress of their student's achievements. The master copy of the performance record is kept on file and is forwarded to the high school when the student leaves the junior high or middle school. The form gives the high school instructor a quick overview of the student's accomplishments and capabilities.

Equipment Operation Checklist (Worksheet 11.4). The stationary equipment and portable power tools used in the shop are listed on this sheet. Before using any of this equipment, students refer to the equipment notebook, film, tape, or other media that have been prepared to explain the operation of each piece of equipment. Students note on their equipment operation checklist the media they referred to in learning how to use a particular stationary equipment or tool. When they feel they can operate the equipment or tool correctly and safely, students ask their instructors to check them out on the equipment. To this point, they have not turned on the power to the equipment or tool.

When the student demonstrates the proper use of the equipment, the instructor initials the student's equipment operation checklist.

There are two classes of power equipment and tools in the shop: Those that can be used by the student at any time once he or she has instructor approval, and those that can be used by the student only with instructor approval even though the student has been cleared to use the equipment. This latter class of equipment is the more dangerous and requires closer instructor supervision. These more dangerous tools are listed at the bottom of the equipment operation checklist.

The equipment operation checklist can be used by the students all the time they are in the program and can be forwarded to the high school with other student records.

Plan Sheet (Worksheet 11.5). This sheet becomes a guide for the student to use in carrying out his project. Space is provided for a sketch and for listing tools and equipment he will need. Then he lists each step or procedure, noting the source of his information about the procedure. The back side of the sheet is a bill of material. Each item, its number, dimensions and cost are listed. The cost is computed before the student starts his project. The plan sheet is initialed twice by the instructor; once when the plan is approved, and again when the project is completed.

Material Cost Record (Worksheet 11.6).
This is a simple ledger form on which the student records his credits (money paid to the school for materials), his debits (charges for materials he buys), and his current balance. The instructor initials both the entry in the credit account and the receipt the student was given at the office. When the balance falls below what he will need to finance a new project, the student makes another payment.

Project Evaluation Form (Worksheet 11.7).
This form is used on completion of each project. The student makes judgments on a scale of 1 to 7 about how satisfied or dissatisfied he is regarding the various aspects of his experience with the project. The instructor may also complete a copy of the form. Student and instructor compare their judgments and from this conference come evaluations of the student's learning and performance.

Parent Permit Slip (Worksheet 11.8).
This form is used to secure the permission of parents for their child to use the power equipment in the shop. The back side of the form lists the shop's general safety rules.

This form can be contained in the student's notebook or filed away. When the student returns this form signed by his parent or guardian, the instructor initials and dates the Equipment Operation Checklist (Worksheet 11.4) in the space marked "Shop Permit". Before operating any power equipment, students must have the safety permit properly signed.

Welcome and Orientation Sheets (Worksheet 11.9).
This should be a readable and informative paper that welcomes the student to the shop, gives him a feeling of anticipation, and provides him the basic information he needs to function effectively as a learner. We presume, of course, that you will begin each term with a tour of the facility and oral explanations of the processes and procedures. The Welcome and Orientation paper can serve the student as a review and a reference. Students entering the program late in the term can be given the paper to study. This should reduce appreciably the time the student needs to learn his way around the job and become involved in a project.

D
SEQUENCE OF FORMS IN STUDENT NOTEBOOK

The order in which the forms appear in each student's notebook is important to facilitate their review and locate them easily. The order and color is as follows:

	Form	Color
(1)	Attendance & Time Utilization (one color for each school quarter)	- Blue, Green, Yellow, Pink
(2)	Student Performance Record	- White
(3)	Equipment Operation Check List	- Green
(4)	Plan Sheet	- White
(5)	Material Cost Record	- Blue

(Insert here plan sheets of completed projects in reverse order of completion so last completed plan sheet is on top.)

(6)	Project Evaluation Form	- Goldenrod
(7)	Parent Permit	- White
(8)	Welcome & Orientation	- White

E
ASSESSMENT

Your ability to look at student notebooks will increase as you work with students. But if each instructor looks at notebooks in a different way it is very difficult for students and teachers to operate in a single facility. The teaching team should decide the steps required to look at a notebook and follow them consistently. A large percentage of any breakdown in program operation can be attributed to inconsistency in notebook procedure by instructors. Failure of students in filling out attendance forms, and keeping up other forms, is often not the fault of students but inconsistency of instructors when working with student notebooks.

The following ten steps suggest a way to look at student notebooks. This procedure may be modified, but whatever plan is established should be followed rigorously. If the student should break the chain of steps, the instructor should ask the student to complete the step and then the instructor should stand aside until it has been done. The underlined words are the key points to check each time a notebook is reviewed.

1. The student will come to you with his plan sheet for approval to start. The plan sheet is the form about which most conversation between teacher and student will take place. The current plan sheet should be inserted between the green and the blue sheets so you can find it easily. Check the sketch, procedures, tools and equipment and bill of material. Is it to your satisfaction?

2. The bill of material section is located on the back of the plan sheet. Look to the right, and you will find the material cost record form. Does the student have enough money in his account and has he or she entered the cost of the proposed project on his cost sheet? If cost form is O.K., go to step 3.

3. Turn to the first form, the attendance sheet, to see that it is up to date. Has the student made a specific statement about his time utilization? "Planned", "sanded", "worked on project", are not specific enough statements. "Was checked out on bandsaw", "Finished candleholder with Danish oil", "Completed plan sheet for welded candleholder project", are good statements for a utilization form. Check attendance and time utilization form. Check the forms to see if they are in the correct order.

4. Return to the plan sheet. If the first three steps are to your satisfaction, sign your initials and date giving the student permission to start working on the project.

5. You will go from student to student and work with students as they complete their projects. Students will then bring finished projects and filled-in evaluation forms to you.

6. Turn to Performance Record to see if the student has given himself credit for the work completed. A quick look at this record will tell you in which activity areas the student has worked. Counsel students to explore other areas. Check Performance Record to see if it is up to date.

7. Check Attendance and Time Utilization form again (Step 3).

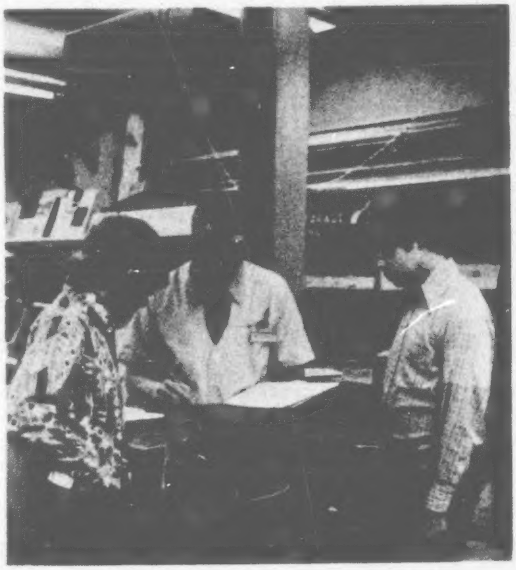
8. You have the student's project in front of you. Check the cost record for additional costs. Does the project contain more material than the bill of material on the plan sheet indicates?

9. Check the Equipment Operation Sheet against the tools and equipment section on the plan sheet. It is nice when students help each other, but if a student enters a piece of equipment on his plan sheet, we expect the student to be checked out on the equipment. When another student performs an operation on a piece of equipment, he or she is taking the experience away from the student with the original project.

10. Read through and discuss the Student Evaluation Form. Is the evaluation form filled out? Find positive things to say about the student's project and counsel the student into another project. This is a good time to discuss the student's performance in solving problems encountered in constructing the project.

The final step in the notebook check is initialing the finished approval section on the Plan Sheet. Initial and date finished approval on Plan Sheet.

If the team members follow a procedure of this type, your program will work much more smoothly.



The Self-Instruction System

In the traditional industrial arts shop, the instructor is the major source of information for learning. In a student-managed learning program, the student learns through interaction with other students and by using a variety of instructional materials.

Instructional materials (media) comprise the self-instruction system. This section of the guide discusses the function of the self-instruction system and presents each of the instructional materials suggested for the system.

One of the developers of the occupational versatility approach to teaching industrial arts has noted that "no one person can teach and manage as many elements or as many components as are found in a junior high exploratory learning situation. That is why there are student management and self-instructional systems."

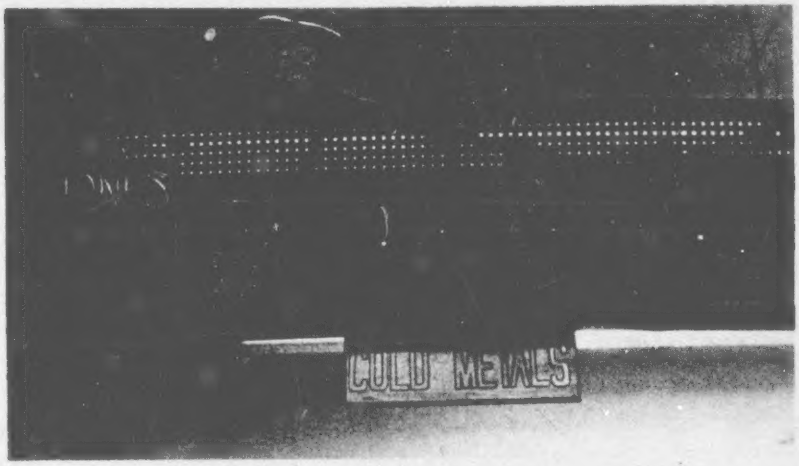
Self-instruction, like student management, shifts dependence from the teacher to the student. The media, not the teacher, becomes the primary source of information. Harvesting information from the media helps to develop self-sufficiency in the student.

A
STUDENTS AS
INSTRUCTORS

As noted earlier, one rationale for the ungraded nature of a student-managed learning program is that experienced students can help the inexperienced. The student who wishes to make a welded candleholder, for example, will likely feel more comfortable discussing the project with a student who has made a candleholder rather than with an instructor. And both will learn from the discussion. Encouraging consultation among students enriches the learning environment of the shop.

B
THE BASIC 10'S

References to the Basic 10's have already been made throughout the guide. A description of their purpose is given in Step 8 of the procedure for installing the Self-Instruction System (Worksheet Series 12). A selection of Basic 10 projects is presented in Appendix B.



As noted earlier, the Basic 10 is central to the Self-Instruction System. A student can choose to make a Basic 10 project, revise a Basic 10, or develop a project of his own. It is hoped that at least 75 percent of the experienced students in the program will be creating their own projects.

It is suggested that you yourself make all Basic 10's that you select so you can anticipate problems that students may face. You may wish to use those included in this guide the first year and then start designing Basic 10's of your own. It should take you, on the average, seven hours to design a project. Your design should include the basic plan, the procedure the student is to follow, references to other information about the procedures involved, and information about the materials and supplies.

C

OTHER MEDIA

In addition to the Basic 10's and their descriptive materials, you will be providing your students with other materials, or medial for self-instruction.

References to these other media have already been made in Step 8 of the procedure for installing the Self-Instruction System (Worksheet Series 12).

Each of these media are described in more detail below. References are made to the appropriate worksheets.

Examples of the printed media appear in Appendix D.

1. Instruction Sheet. A step-by-step procedure for accomplishing a process; may be illustrated; may include both pre- and post-test to help students check themselves on how well they read and understand the instructions.

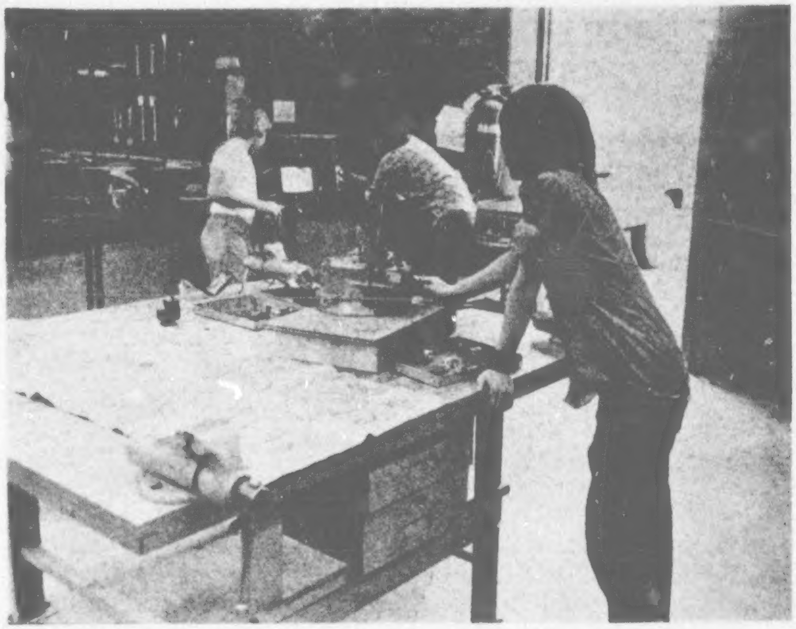
2. Cassette Tape. Serves the same purpose as the instruction sheet. The spoken word is particularly helpful to students who read with difficulty. Tapes can be made locally by the staff to explain processes and procedures not explained elsewhere. Tapes can also be purchased in combination with filmstrips (See Worksheet 12.15).

3. Single-Concept Film Loops. One or more 8mm films that illustrate a process. Useful for showing conditions or techniques that involve motion (running a bead in welding, or laminating acrylics). A selected list of film loops listed by activity area is given in Worksheet 12.13.

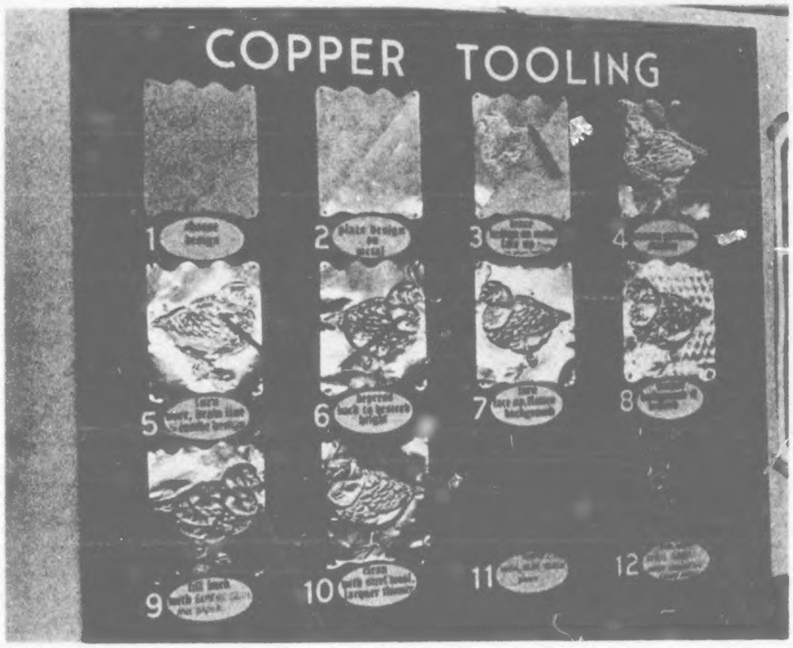
PROCEDURES FOR MAKING A SIGN

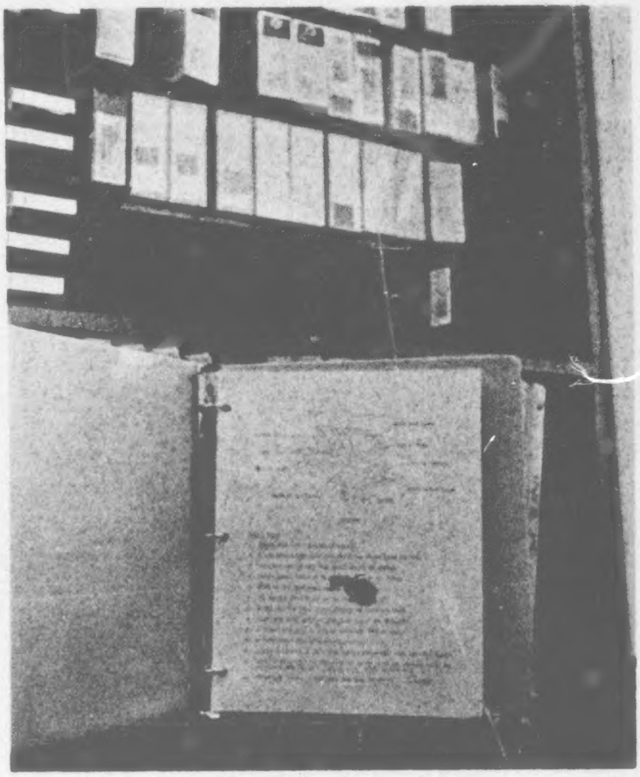
4. Chart. A large drawing or series of drawings, usually designed for mounting on the wall, which describes a process.

5. Slides, Film Strips. A single picture or a series of pictures produced as transparancies that illustrate a condition or process. These can be produced locally or can be purchased (see Worksheet 12.15).



6. Model. A mock-up or replica of a device, such as a slide rule or electric motor, that students can operate manually or assemble and disassemble in order to learn how the device functions.


COPPER TOOLING
1
choose design
2
place design on metal
3
4
5
6
7
8
9
10
11
12



7. Power Equipment Notebook. Prepared for each piece of stationary or portable power equipment in the shop; includes operating instructions and emphasizes safety precautions.

A set of equipment operation sheets is included in Appendix D.

8. Information Sheet. Contains information about a process (example: how to laminate) where instructions and/or pre- and post-testing are not necessary.

9. Book. A handbook, guide or text published by a manufacturer or textbook publisher which includes instructions and other information related to one or more processes.

Worksheets 13.1-13.10 have selected bibliographies of these types of print materials, arranged by activity area.

Organizing the Staff

A
ROLE OF THE
INSTRUCTOR

In the traditional shop, the instructor is number one. He does the teaching. The students learn his way of doing things.

The Career Exploration/Industrial Arts Program places learning in the hands of the student. The student manages his learning and turns to printed and audio-visual materials for much of his information. The instructor becomes a coordinator and a facilitator. He is still very much an information resource to the student; but his role is to assure that learning takes place, not to take charge of the learning.

A comparison of how an average teacher is likely to spend his time in a traditional shop and in a student-managed learning shop is presented in Table 2. The table illustrates how the student-managed learning approach frees the instructor from management chores and allows him more time to work with students.

Some industrial arts teachers can be coordinators and facilitators. Others find it difficulty or next to impossible to adopt a new role in the shop. Teaching in a Career Exploration Program is not for everyone.

Even those who can make a commitment to student-managed learning need every opportunity to study the basic concepts, discuss the program with others, and observe a Career Exploration Program in operation. This can be done through pre- and in-service seminars, through discussions with consultants and industrial arts specialists, and by visiting established programs.

The trauma of plunging inexperienced instructors into a new program will be eased by giving them a chance to test the water first.

TABLE 2

HOW DOES A TEACHER SPEND HIS TIME?

In A Traditional Shop		In A Student-Managed Learning Shop
10.7	Student Guidance (Guide student to solution of problem, to references, and discuss ideas with him.)	48.3
5.0	Performance Evaluation (Discuss with student his feelings about his work, talents, abilities, future.)	33.3
35.7	Dissemination of Information (Lecturing, demonstrating, testing, answering questions, giving assignments.)	6.7
29.4	Managing Materials (Punching shop cards, selling and dispensing materials, keeping records, collecting fees, ect.)	11.7
12.2	Performance Measuring (Grading projects and/or testing, entering grades in grade book.)	0
7.2	Checking Attendance (Calling roll, entering attendance in book.)	0
100.0		100.0

B
THE TEACHING TEAM

The success of a single, open shop depends upon a team approach to teaching. At Calapooya Junior High, for example, three teachers work with 75-80 students each period for six periods a day. Pilot Butte Junior High teachers have 60-65 students in their shop seven periods each day. With these numbers of students and the size of each shop, it is imperative that the teachers work together as a team.

Team teaching is an art. It's an attitude, a frame of mind. Two, three, or more instructors must commit themselves to common goals, sharing responsibilities, consistency in program procedures, and points of view. They must put the needs and interests of students ahead of their own. The ability of the teachers to work as a team is one, if not the most, important factor in a successful Career Exploration Program.

Team teaching is not easy, but there are strategies and procedures that can help individual instructors become effective team members. At Calapooya and Pilot Butte Junior High Schools, for example, teachers have written a set of by-laws to govern the operation of the instructional team. The by-laws are presented in Appendix E.

The by-laws make communication and decision-making possible. Since decisions are reached by consensus, each member has an equal part in the decision-making process. Self-evaluation of decisions can also take place because the team members set up the evaluation criteria without fear. Weekly meetings are held with the agenda and minutes of these meetings distributed to the team members, building principal and district Career Education Director.

Since the team members require time to meet and continually upgrade their program, common preparation periods for team members is a good idea. This common preparation period gives the team the opportunity to function as a unit and solve problems as a team.

VI
WORKSHEETS AND VENDOR LIST

Inserted in this part of the guide are the worksheets referred to in previous sections.

The worksheets are planning tools; when complete, they become your plan for a new Career Exploration/ Industrial Arts facility and program. The plan will include cost and time estimates and a time line for installing the facility.

All the worksheets are written in the same format. Each is numbered and titled; a statement of purpose explains the nature of the information explained by the worksheet.

You will find that the worksheets are both information-giving and information-generating; that is, they provide you with information but they also help you generate additional information you need to accomplish your planning.

Included are color specifications that will be helpful in planning the color to be used in color coding areas, equipment and certain materials.

Also included in the information given on the worksheets are vendor code numbers. The numbers refer to those vendors known at the time this guide is published to be marketing any of the materials and equipment referred to on the worksheet. The vendors are listed on the sheet immediately following this page.

Note that the vendor list is not complete. It is impossible to search out and list every firm that is selling a particular item. The appearance of a firm on the list does not imply a recommendation over other firms which may have inadvertently been left off the list.

Finally, each worksheet includes space to complete the bill of materials, estimate the cost and estimated time. In some cases, a suggested estimated time appears in parenthesis. This suggestion may help make your own time estimate.

Estimated costs and times are carried forward to a cost summary sheet (Worksheet 15).

VENDOR LIST

1. ALLIED ELECTRONICS
12311 Industry
Garden Grove, CA
Phone: (213) 598-6605

2. AMERICAN HANDICRAFT
4300 N. E. Sandy Blvd.
Portland, OR 97213
Phone: (503) 288-5701

3. AMERICAN STEEL & SUPPLY
4033 N. W. Yeon
Portland, OR 97210
Phone: (503) 226-1511

4. AUDIO VISUAL SUPPLY CO.
6420 N. E. Halsey
Portland, OR 97213
Phone: (288-6102)

5. BARBO MACHINERY CO.
1126 S. E. Division
Portland, OR 97202
Phone: (503) 232-8158

6. BFA EDUCATIONAL MEDIA
909 N. E. Linden
Hillsboro, OR 97123

7. BRODHEAD-GARRETT
13538 Tiki Lane
Springfield, OR 97477
Phone: (503) 746-8525

8. BROWN & WISER, INC.
1411 N.W. Flanders
Portland, OR 97209
Phone: (503) 226-1111

9. BRUCE PUBLISHING CO.
8701 Wilshire
Beverly Hills, CA
Phone: (213) 657-4800

10. BRUNING CO.
2136 S. W. Fifth
Portland, OR 97210
Phone: (503) 224-4120

11. BUTTERWORTH, INC.
5417 N. E. 30th Avenue
Portland, OR 97211
Phone: (503) 288-6733

12. CHARLES A. BENNETT CO., INC.
809 West Detweiller Drive
Peioria, IL 51614
Phone: (309) 691-4454

13. CHOWN HARDWARE
333 N. W. 16th
Portland, OR 97209
Phone: (800) 452-7634

14. COMARK PLASTICS DIVISION
1407 Broadway
New York, NY 10018
Phone: (212) 564-6000

15. COPE PLASTICS, INC.
4441 Industrial Drive
Godfrey, IL 62035
Phone: (618) 466-0221

16. CRAFTOOL COMPANY, INC.
1421 S. 240th Street
Harbor City, CA 90710
Phone: (213) 325-9696

17. DELMAR PUBLISHERS
P. O. Box 5087
Albany, NY 12205
Phone: (518) 459-1150

18. DELVIE'S PLASTIC, INC.
2320 S.W. Temple
Salt Lake City, UT 84110
Phone: (801) 467-1548

19. DIETZGEN CORPORATION
1550 Hymer Avenue
Sparks, NV 89431
Phone: (800) 648-1136

20. DISTRICT MAINTENANCE

21. EMERSON HARDWOOD CO.
2279 N. W. Front Avenue
Portland, OR 97209
Phone: (503) 227-6414

22. EVERGREEN TOOL CO.
2429 S. E. 11th
Portland, OR 97214

23. EYE-GATE HOUSE
146-01 Archer Ave.
Jamaica, NY 11435
Phone: (212) 291-9100

VENDOR LIST (Con't)

24. GENERAL TOOL & SUPPLY CO.
407 N. W. 17th
Portland, OR 97209
Phone: (800) 452-3505

25. GOODHEART-WILLCOX
123 West Taft Drive
South Holland, IL 60473
Phone: (312) 333-7200

26. HONACAST DIVISION
400 Walnut Street
Yonkers, NY 10701
Phone: (914) 423-2146

27. HOWARD W. SAMS & CO., INC.
4300 West 62nd Street
Indianapolis, IN 46268
Phone: (317) 291-3100

28. INDUSTRIAL ARTS SUPPLY CO.
5724 West 36th Street
Minneapolis, MN 55416
Phone: (612) 920-7393

29. J. K. GILL CO.
2725 N. W. Industrial
Portland, OR 97210
Phone: (503) 226-4611

30. KEUFFEL & ESSER CO.
P. O. Box 2030
Seattle, WA 98111
Phone: (206) 623-5535

31. LA GRAND INDUSTRIAL SUPPLY
2620 S. W. First
Portland, OR 97201
Phone: (503) 224-5800

32. LEMONS MILLWORK, INC.
224 East 31st
Albany, OR 97321
Phone: (503) 926-1463

33. LIBRARY FILM STRIP CENTER
3033 Aloma
Wichita, KA 67211

34. LOCAL CABINET COMPANY

35. LOCAL ELECTRICAL VENDOR

36. LOCAL HARDWARE STORE

37. LOCAL LUMBER DEALER

38. LOCAL PAINT STORE

39. LOCAL PRINTER

40. LOCAL STATIONERY STORE

41. LOCAL VENDOR

42. LOCAL WELDING VENDOR

43. LUMBER PRODUCTS
2116 N. W. 20th Ave.
Portland, OR 97209
Phone: (503) 223-8170

44. McGRAW-HILL BOOK CO.
8171 Redwood Highway
Novato, CA 94947
Phone: (415) 897-5294

45. McGRAW HILL FILM DIVISION
330 West 42nd Street
New York, NY 10036

46. McKNIGHT PUBLISHING CO.
Bloomington, IL 61701
Phone: (309) 663-1341

47. MONITOR PRODUCTS
300 South Alaska
Tacoma, WA 98409
Phone: (206) 475-5800

48. MOORE'S AUDIO VISUAL CENTER, INC.
234 S.E. 12th
Portland, OR 97214
Phone: (503) 233-5621

49. NATIONAL BUILDERS HARDWARE CO.
1215 S. E. 8th
Portland, OR 97214
Phone: (503) 233-5381

50. NORTH PACIFIC LUMBER CO.
P. O. Box 3915
Portland, OR 97208
Phone: (503) 234-8241

51. OREGON STATE UNIVERSITY
Industrial Education Department
Corvallis, OR 97331
Phone: (503) 754-2733

52. PACIFIC METAL CO.
3400 S. W. Bond
Portland, OR 97201
Phone: (503) 227-0691

53. SEARS, ROEBUCK & CO.

54. STANDARD PAPER CO.
P. O. Box 2134
Tacoma, WA 98401
Phone: (206) 922-8792

55. STAR MACHINERY CO.
3325 N. W. Yeon
Portland, OR 97210
Phone: (503) 226-3011

56. STERLING FILMS
1110 N. W. Garfield
Corvallis, OR 97330
Phone: (503) 753-8562

57. SUNSET - LOCAL BOOK STORE

58. TANDY LEATHER CO.
5132 N. E. Sandy Blvd.
Portland, OR 97213
Phone: (503) 282-7121

59. TELEDYNE POST
1915 4th Avenue South
Seattle, WA 98134
Phone: (206) 622-0888

60. THORNE FILMS, INC.
Dept. 1A-73
1229 University Ave.
Boulder, CO 80302
Phone: (303) 443-4480

61. TOMAHAWK CORPORATION
748 East Walnut
Hillsboro, OR 97123
Phone: (503) 648-5622

62. TUCKER & SONS
P. O. Box 8008
Tacoma, WA 98408
Phone: (206) 474-8426

63. UNITED RADIO SUPPLY, INC.
123 N.E. 7th Avenue
Portland, OR 97232
Phone: (503) 233-5346

64. WEST COAST PAPER CO.
2203 1st Avenue South
Seattle, WA
Phone: (206) 623-1850

65. WESTERN INDUSTRIAL SUPPLY CO.
208 S.E. Hawthorne Blvd.
Portland, OR 97214
Phone: (503) 639-5913

WORKSHEET # 1

ACTIVITY AREAS LISTING BY PRIORITY

PURPOSE: In the spaces opposite each suggested activity area, check those you consider essential, of high priority, and of lesser priority. These can be tentative judgments, but may be useful as guides to planning from this point on. You may wish to select activity areas other than those listed.

ACTIVITY	ESSENTIAL	HIGH PRIORITY	LESSER PRIORITY
1. Woods			
2. Cold Metals			
3. Hot Metals			
4. Plastics			
5. Crafts			
6. Power Mechanics			
7. Graphics			
8. General Industries			
9. Electricity, Electronics			
10. Drafting			
11. Planning (Media)			
12. Finish			
13. ________			
14. ________			
15. ________			

WORKSHEET # 2

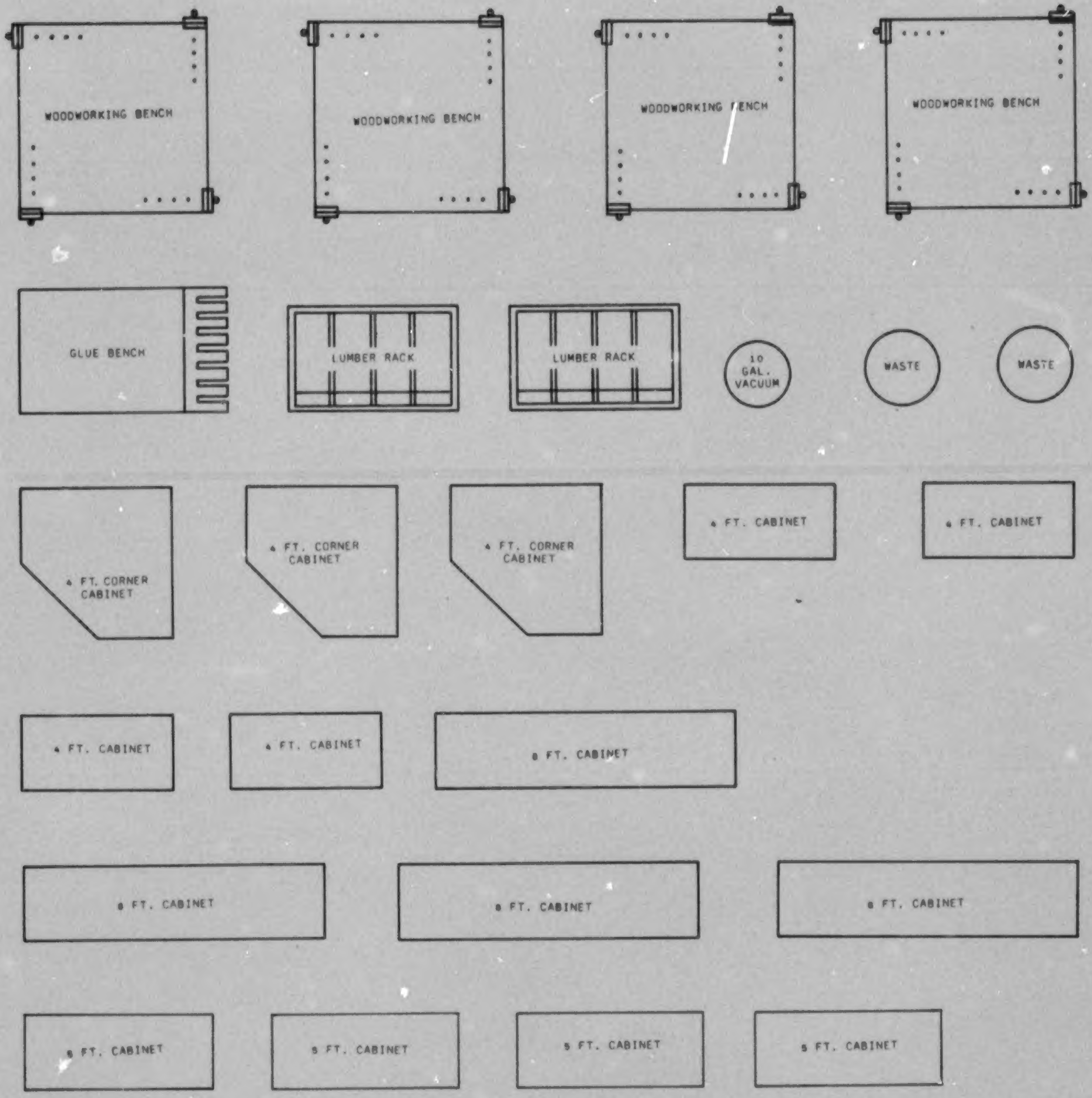
CASEWORK CUTOUTS

PURPOSE: Worksheets 2.1, 2.2, 2.3, etc. provide you with cutouts of the casework you will need to install for each of the activity areas you wish to establish. The 8', 4' and corner cabinets were constructed for the Albany pilot program and have worked well. If you are constructing a new facility you may wish to use 5' cabinets.

As noted earlier, the cutouts are to be pinned to the perimeter drawing of your remodeled facility (page 34), or can be used for preliminary planning if your program is to be housed in new construction.

WORKSHEET #2.1

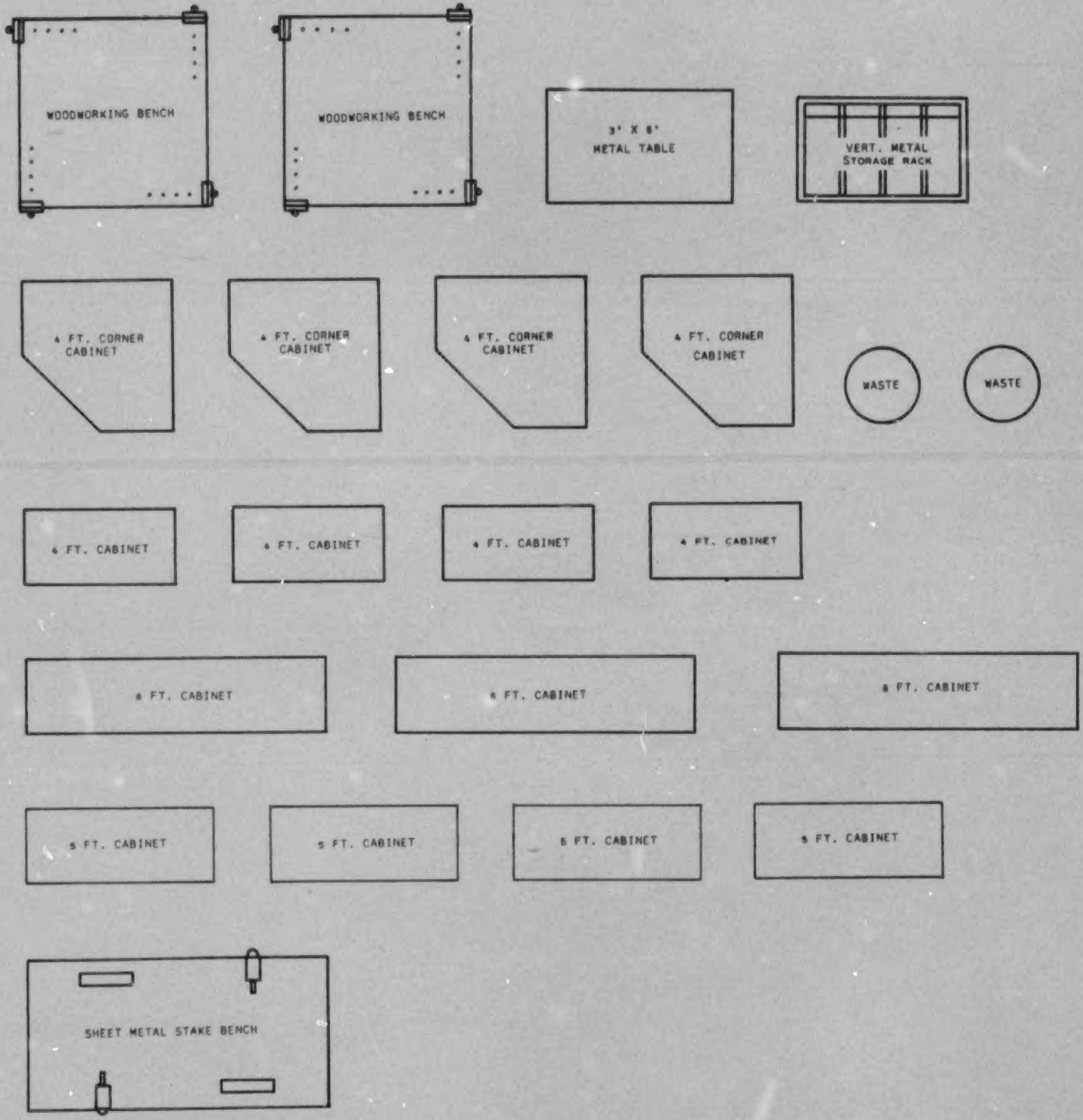
WOODS CASEWORK CUTOUTS



WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
GLUE BENCH
LUMBER RACK
LUMBER RACK
10 GAL. VACUUM
WASTE
WASTE
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
8 FT. CABINET
8 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET

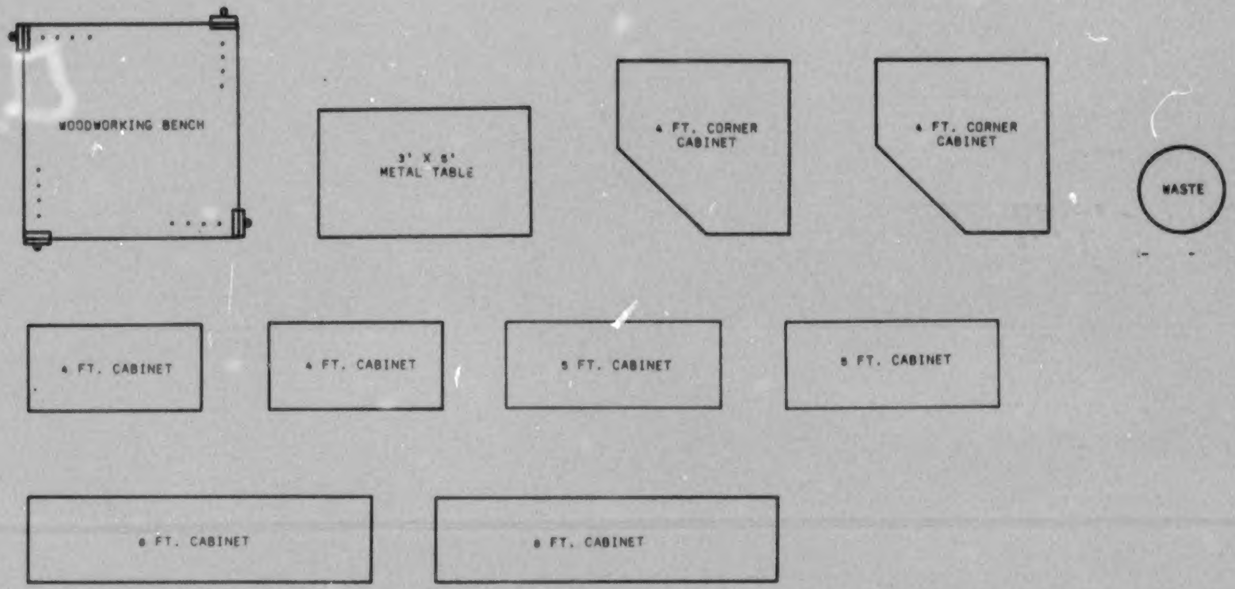
WORKSHEET # 2.2

COLD METALS CASEWORK CUTOUTS


WOODWORKING BENCH
WOODWORKING BENCH
3' X 6' METAL TABLE
VERT. METAL STORAGE RACK
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
WASTE
WASTE
4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
8 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
SHEET METAL STAKE BENCH

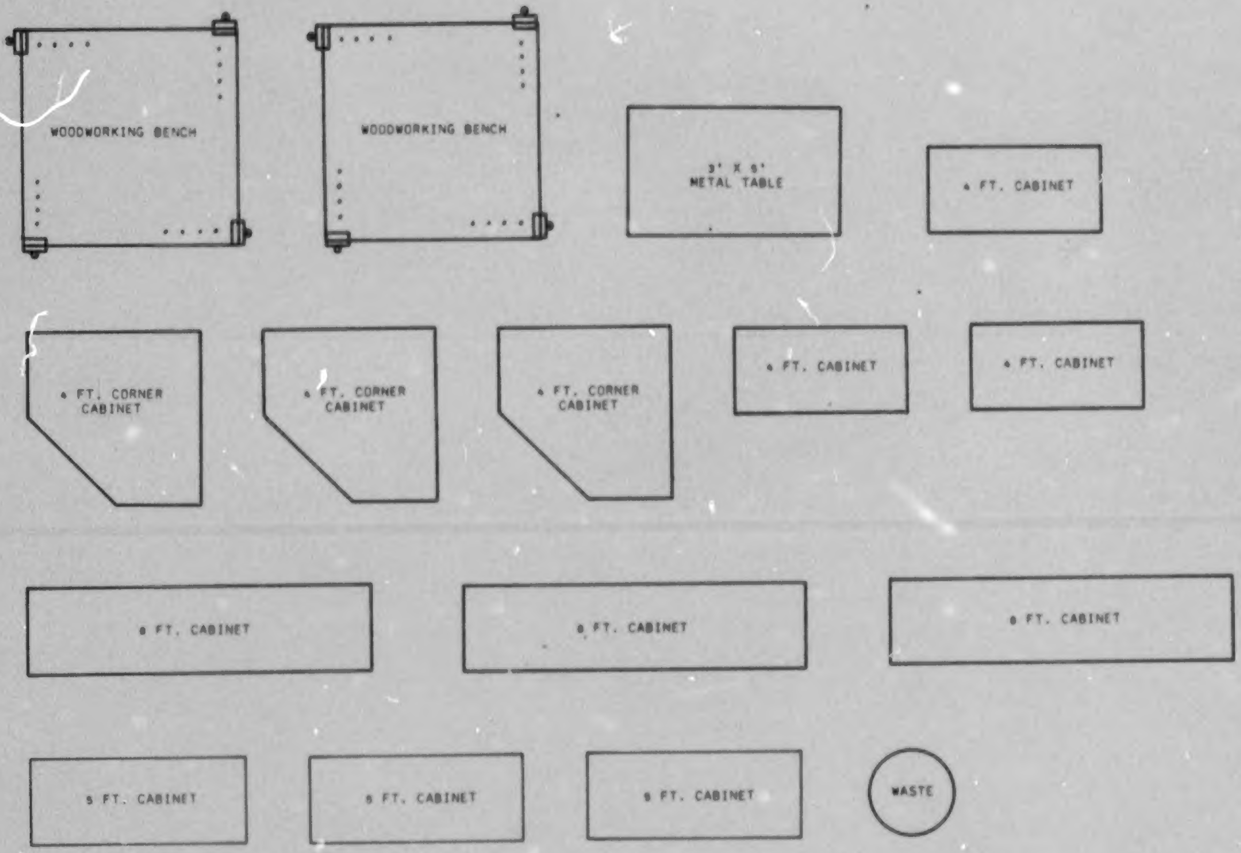
WORKSHEET # 2.3

HOT METALS CASEWORK CUTOUTS


WOODWORKING BENCH
3' X 5'
METAL TABLE
4 FT. CORNER CABINET
4 FT. CORNER CABINET
WASTE
4 FT. CABINET
4 FT. CABINET
5 FT. CABINET
5 FT. CABINET
8 FT. CABINET
8 FT. CABINET

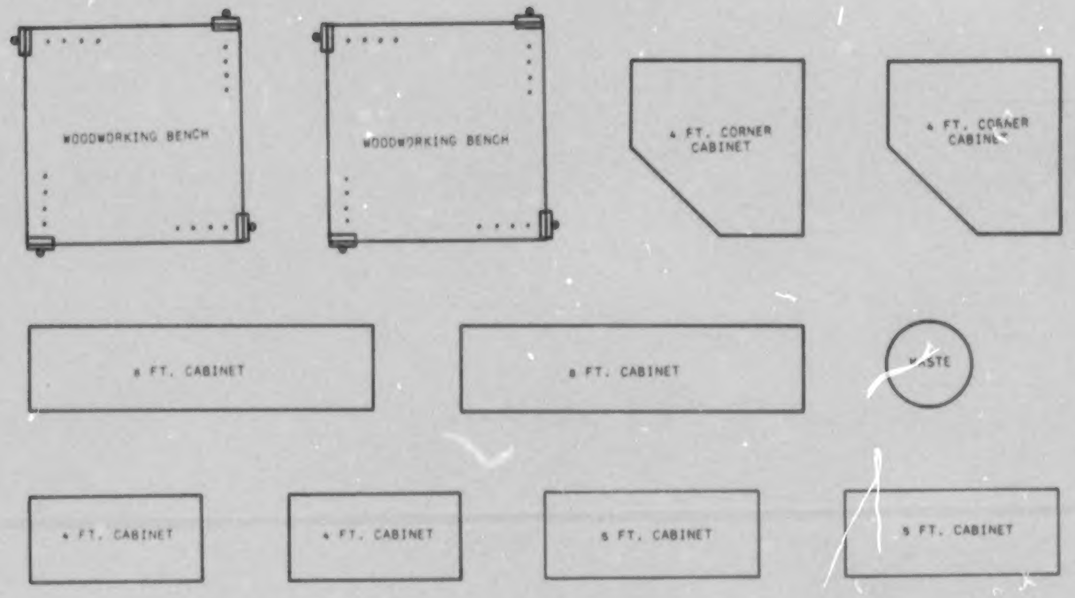
WORKSHEET # 2.4

PLASTICS CASEWORK CUTOUTS


WOODWORKING BENCH
WOODWORKING BENCH
3' X 5' METAL TABLE
4 FT. CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
8 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
WASTE

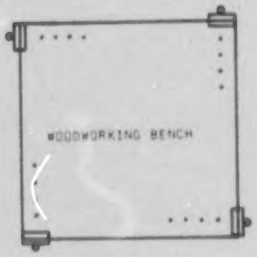
WORKSHEET # 2.5

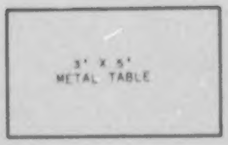
CRAFTS CASEWORK CUTOUTS

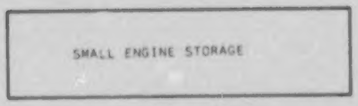

WOODWORKING BENCH
WOODWORKING BENCH
4 FT. CORNER CABINET
4 FT. CORNER CABINET
8 FT. CABINET
8 FT. CABINET
WASTE
4 FT. CABINET
4 FT. CABINET
5 FT. CABINET
5 FT. CABINET

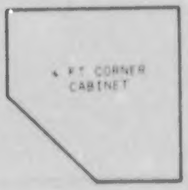
WORKSHEET # 2.6

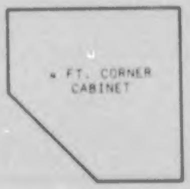
POWER MECHANICS CASEWORK CUTOUTS

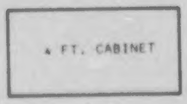

WOODWORKING BENCH

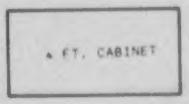

3' X 5'
METAL TABLE

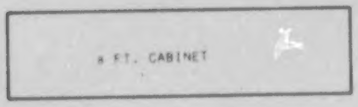

SMALL ENGINE STORAGE

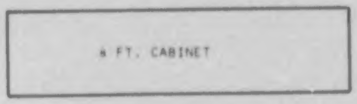

4 FT CORNER
CABINET

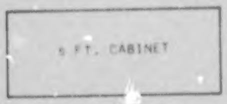

4 FT. CORNER
CABINET

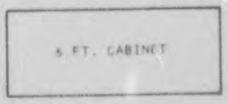

4 FT. CABINET


4 FT. CABINET


8 FT. CABINET

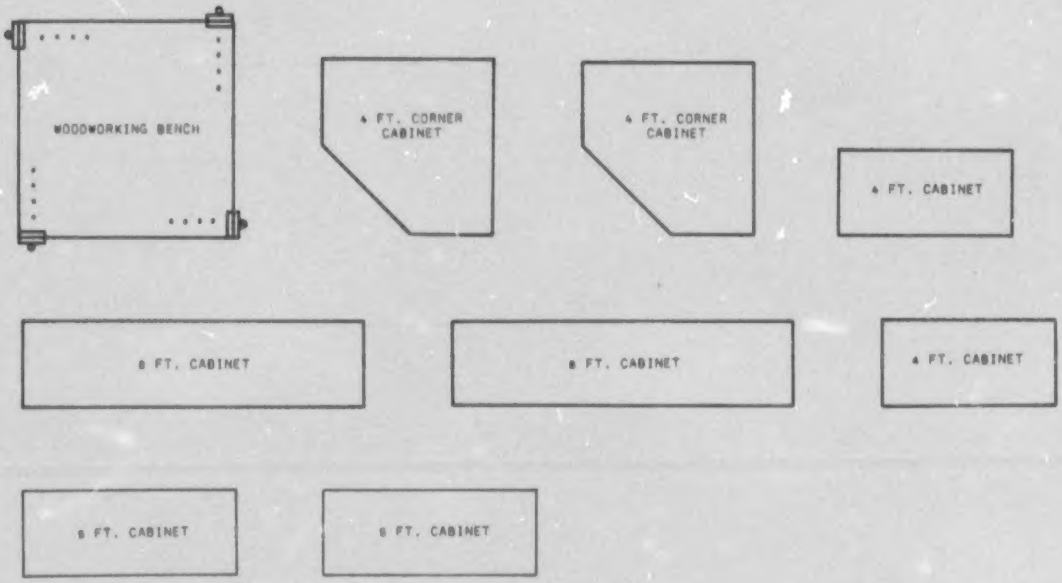

8 FT. CABINET


5 FT. CABINET


5 FT. CABINET

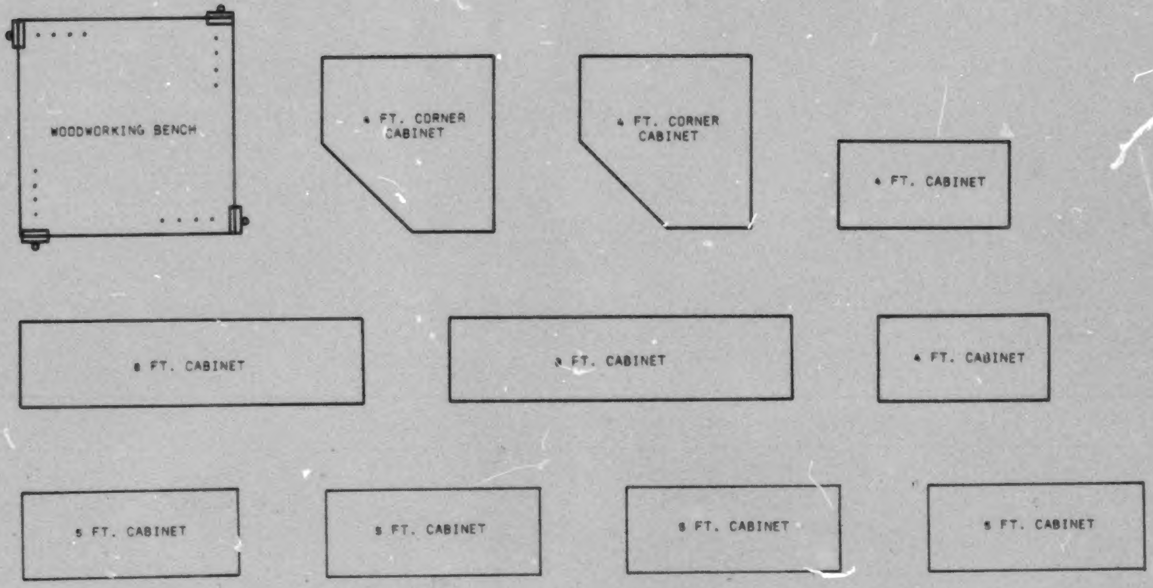
WORKSHEET # 2.7

GRAPHICS CASEWORK CUTOUTS


WOODWORKING BENCH
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
4 FT. CABINET
5 FT. CABINET
5 FT. CABINET

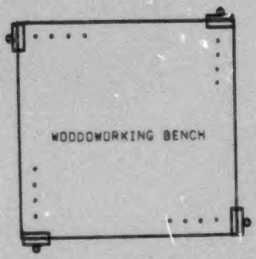
WORKSHEET # 2.8

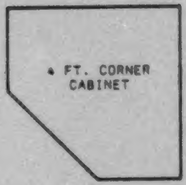
GENERAL INDUSTRIES CASEWORK CUTOUTS

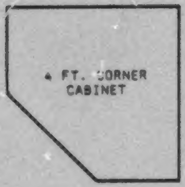

WOODWORKING BENCH
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
4 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET

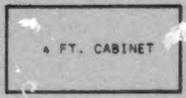
WORKSHEET # 2.9

ELECTRICITY/ELECTRONICS CASEWORK CUTOUTS


WOODWORKING BENCH

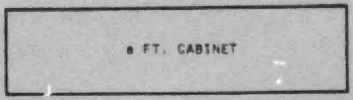

4 FT. CORNER CABINET


4 FT. CORNER CABINET


4 FT. CABINET

4 FT. CABINET

8 FT. CABINET

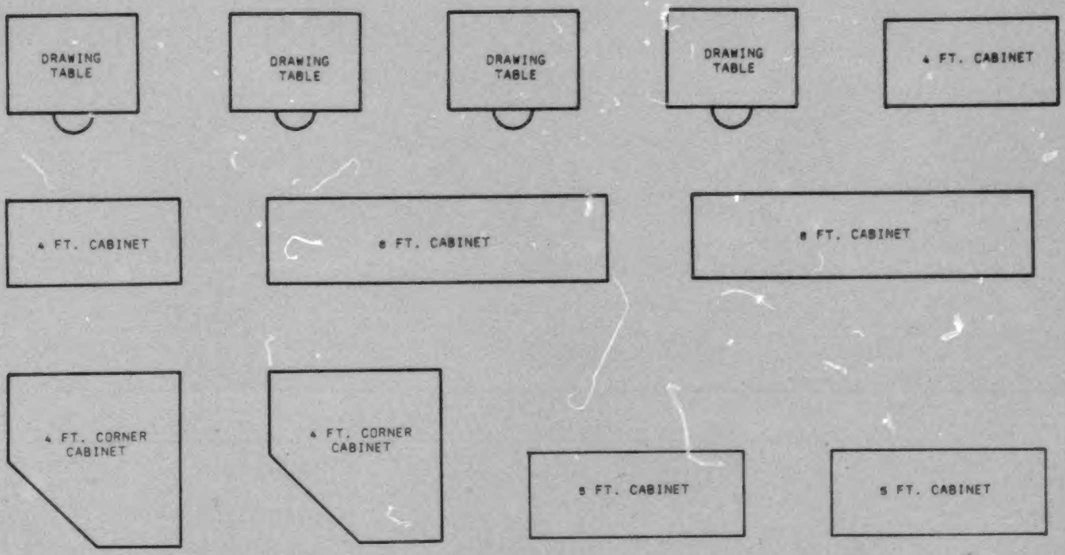

8 FT. CABINET

5 FT. CABINET

5 FT. CABINET

WORKSHEET # 2.10

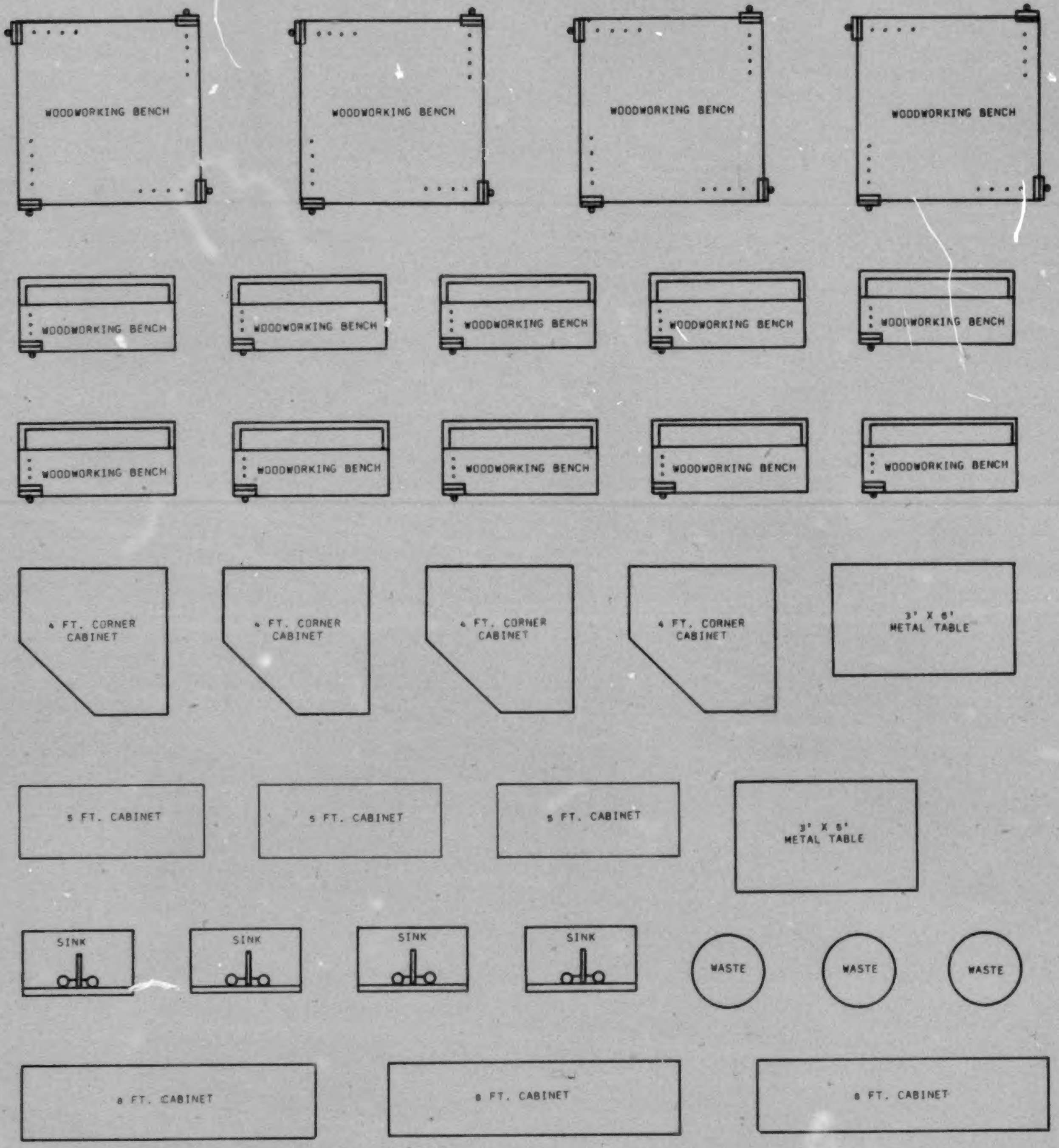
DRAFTING CASEWORK CUTOUTS


DRAWING TABLE
DRAWING TABLE
DRAWING TABLE
DRAWING TABLE
4 FT. CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
5 FT. CABINET
5 FT. CABINET

WORKSHEET # 2.11

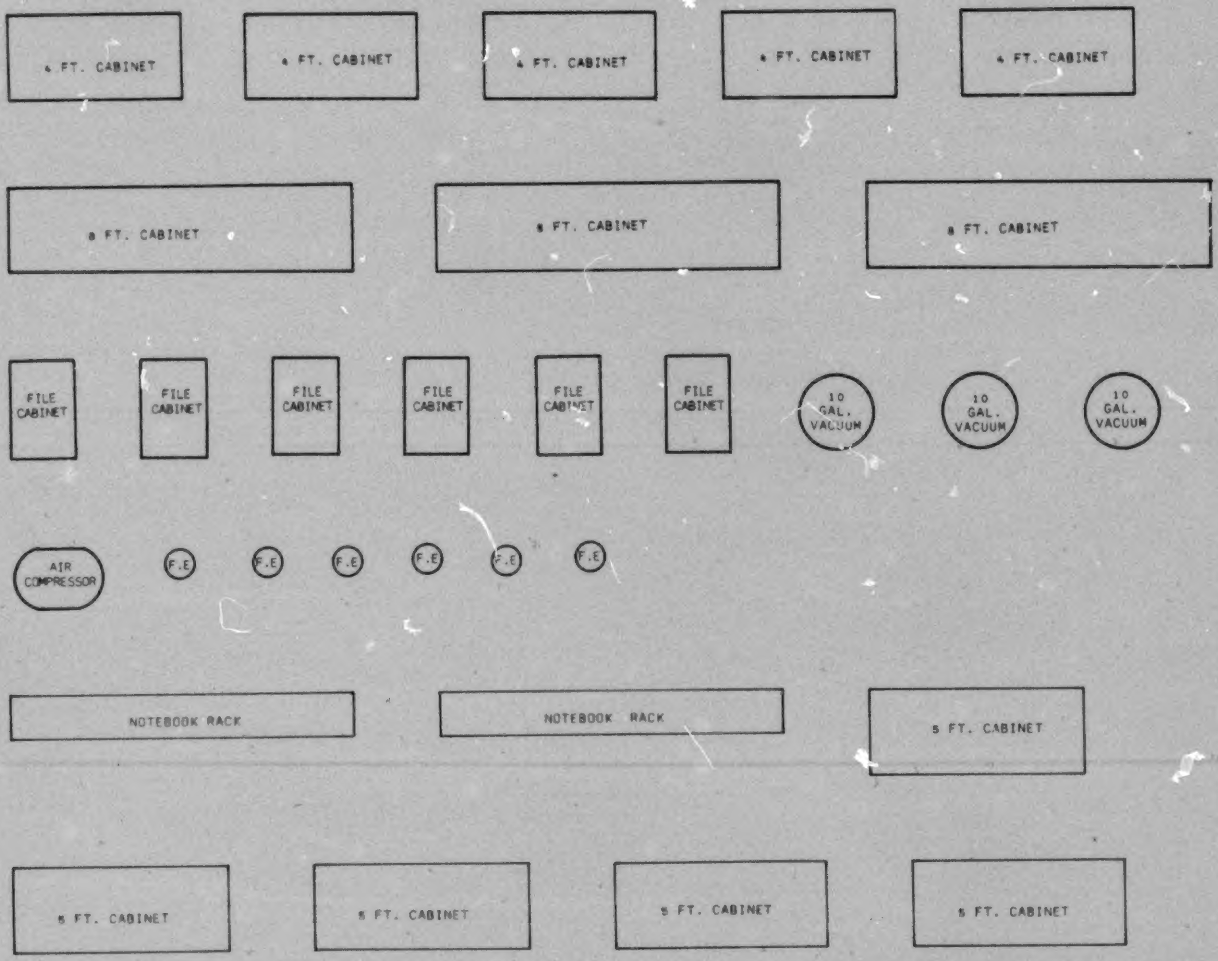
GENERAL SHOP CUTOUTS

PURPOSE: The cutouts below are the items to help you give your facility design the finishing touches. If you have found that you need other cutouts, simply cut out blank sheets of paper, to ¼" scale, and label for the needed item. Use these cutouts to design your finish and planning area if you run short of casework cutouts from other sections.


WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
WOODWORKING BENCH
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
4 FT. CORNER CABINET
3' X 6' METAL TABLE
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
3' X 5' METAL TABLE
SINK
SINK
SINK
SINK
WASTE
WASTE
WASTE
8 FT. CABINET
8 FT. CABINET
8 FT. CABINET

WORKSHEET # 2.11 (Continued)

GENERAL SHOP CUTOUTS


4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
4 FT. CABINET
8 FT. CABINET
8 FT. CABINET
8 FT. CABINET
FILE CABINET
FILE CABINET
FILE CABINET
FILE CABINET
FILE CABINET
FILE CABINET
10 GAL. VACUUM
10 GAL. VACUUM
10 GAL. VACUUM
AIR COMPRESSOR
F.E
F.E
F.E
F.E
F.E
F.E
NOTEBOOK RACK
NOTEBOOK RACK
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET
5 FT. CABINET

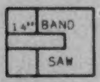
WORKSHEET # 3

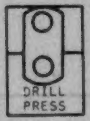
EQUIPMENT CUTOUTS

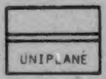
PURPOSE: The following cutouts are of stationary equipment that will occupy floor space in your facility. The cutouts, drawn to a ¼" scale, are to be pinned to the perimeter drawing of your facility (page 34). As you plan the locations of these pieces of equipment, keep the following points in mind:

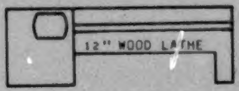
1. Try to place isolated machine areas so students are not traveling back and forth through the area to obtain tools, supplies, etc.
2. If you cluster equipment, space can be saved.
3. You may consider an island machine area so that needed wall space is saved.
4. Equipment on the dust collection system may need to be clustered for better efficiency.
5. Design your machine area so that it is visible from all points of your shop.
6. Consider the space and kickback area needed when positioning the table saw.

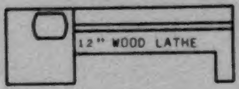
WOODS EQUIPMENT CUTOUTS

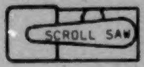


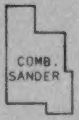

DRILL PRESS

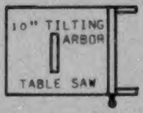


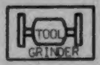

12" WOOD LATHE


12" WOOD LATHE

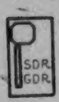


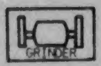

COMB.
SANDER

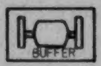

10" TILTING
ARBOR
TABLE SAW

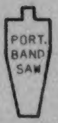

TOOL
GRINDER

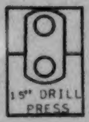
COLD METALS EQUIPMENT CUTOUTS

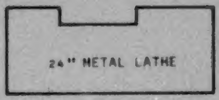


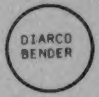


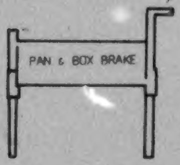


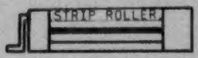

PORT.
BAND
SAW

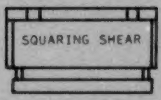

15" DRILL
PRESS


24" METAL LATHE


DIARCO
BENDER


PAN & BOX BRAKE

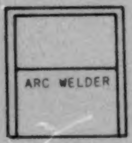

STRIP ROLLER

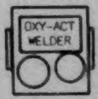

SQUARING SHEAR

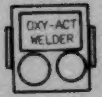
WORKSHEET # 3 (continued)

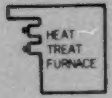
EQUIPMENT CUTOUTS

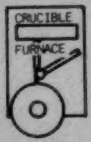
HOT METALS EQUIPMENT CUTOUTS

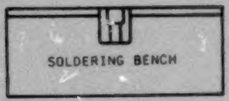


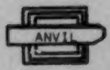

OXY-ACT WELDER

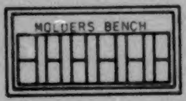

OXY-ACT WELDER


HEAT TREAT FURNACE

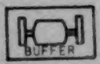

CRUCIBLE FURNACE

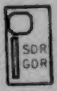

SOLDERING BENCH

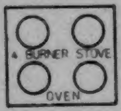


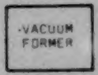

MOLDERS BENCH

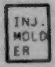
PLASTICS EQUIPMENT CUTOUTS

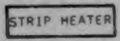


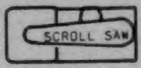



4 BURNER STOVE
OVEN

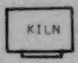

VACUUM FORMER



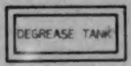

STRIP HEATER



CRAFTS EQUIPMENT CUTOUTS



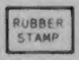
POWER MECHANICS EQUIPMENT CUTOUTS

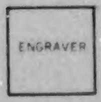

DEGREASE TANK

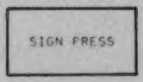
WORKSHEET # 3 (continued)

EQUIPMENT CUTOUTS

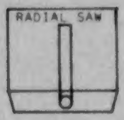
GRAPHICS EQUIPMENT CUTOUTS


RUBBER STAMP

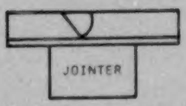


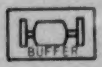


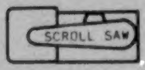
GENERAL INDUSTRIES EQUIPMENT CUTOUTS

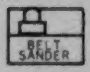


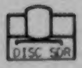
MISCELLANEOUS EQUIPMENT CUTOUTS








BELT SANDER



WORKSHEET # 4

REMODELING

PURPOSE: The worksheets that follow may be used to determine what has to be done to remodel your facility to meet the needs of your new student-managed learning program in the industrial arts. As noted in the text, remodeling does not include installation of casework and fixtures, only structural changes to accomodate your new floor plan. (Page 35)

WORKSHEET # 4.1

WALLS (REMODELING)

PURPOSE: The remodeling of some shops calls for the removal or addition of wall sections, and in other cases, wall sections will be required. Within the wall sections you may encounter windows, plumbing and electrical wiring that will also need removing.

COLOR CODING: None

VENDOR I.D. #: 20, 41

BILL OF MATERIAL: Use the space below to list the tasks involved in adding or removing wall sections.

Feet of Wall Removal ____________ @ ____________ per foot Cost ____________

Feet of Wall Addition ____________ @ ____________ per foot Cost ____________

Other Tasks:

____ Cost ____________

____ Cost ____________

____ Cost ____________

MATERIAL COST: To determine costs, the following questions should be asked:

1. Will the shop staff do the remodeling?
2. Can the district maintenance staff complete the remodeling?
3. Can we use students during school time to work on wall removal or construction?
4. Will the job of remodeling be completed by a commercial company?

EST. COST ____________

TIME: Only figure time if you plan to work on the wall remodeling.

EST. TIME ____________

WORKSHEET # 4.2

ELECTRICAL (REMODELING)

PURPOSE: The electrical work required in remodeling a shop can be extensive and costly. Following is a list of considerations and recommendations, with regard to the electrical phase, when setting up a career exploration program:

1. Note drop cord wiring when relocating and installing old and new equipment.
2. Determine number of drop cords above work benches.
3. The electrician will have to know the amperage requirements for each piece of equipment to determine numbers of circuits to install.
4. Electrical work may be required when removing or installing wall sections.
5. Determine the number of new wall recepticals needed. Suggest continuous wall strips for flexibility.
6. Install panic switch near main power panel.
7. Color code power panel.
8. Remove old wiring from conduit in cement flooring.
9. Relocate electrical heaters.
10. Relocate clocks and intercoms.

COLOR CODING: Paint power panel red.

VENDOR I.D. #: 20, 35

BILL OF MATERIAL: In the space provided, list the tasks, costs and description of the tasks. Check with maintenance for help in determining costs.

TASK	DESCRIPTION OF TASK	COST
Installing equipment		
Drip cords and location		
Wall recepticals		
Main power panel		
Heaters		
Clock and intercoms		
equipment amperage		
hood wiring - welding - finish		
Dust collector		

MATERIAL COST: Add up the cost of the tasks or arrive at estimated cost with help of staff members or maintenance people.

EST. COST ______________

TIME: This work will probably be completed by district maintenance or a commercial company.

EST. TIME ______________

WORKSHEET # 4.3

SHEET METAL (REMODELING)

PURPOSE: When considering sheet metal, we are mainly concerned with hoods, snorkels for welding and dust collection systems. Heating and cold air returns within a facility may require some duct work. Sheet metal attachments to equipment may be needed when installing a dust collection system.

COLOR CODING: None

VENDOR I.D. #: 20, 41

BILL OF MATERIAL: Pencil in the tasks, description of tasks, and costs.

TASK	DESCRIPTION OF TASK	COST
Dust Collection System		
Welding Snorkel		
Hoods & Sizes		

MATERIAL COST: A sheet metal man from your community could be a good resource person to contact.

EST. COST ____________

TIME: If the sheet metal work is done by a commercial company, don't figure in the time as it will be part of the cost.

EST. TIME ____________

WORKSHEET # 4.4

PLUMBING (REMODELING)

PURPOSE: The plumbing required when setting up a career exploration program usually is made up of a number of small jobs:

1. Connecting gas to forges, furnaces and solder benches.
2. Relocating sinks, drinking fountains and vent pipes.
3. Installing new traps in sinks.
4. Removing and adding plumbing in wall sections.
5. Possible relocation of water pipes if you have hot water heating.

COLOR CODING: None

VENDOR I.D. #: 20, 41

BILL OF MATERIAL: This list includes some of the items you will be concerned with when figuring your cost for plumbing remodeling. Check with other staff members and district maintenance for assistance in figuring cost.

TASK	DESCRIPTION OF TASK	COST
Gas Lines		
Forges		
Furnace		
Soldering Bench		
Sinks		
Traps		
Drinking Fountains		
Vent Pipes		
Removing Pipes		
Adding Pipes		

MATERIAL COST: Before you can figure costs, you should know who is to complete the tasks.

EST. COST ______________

TIME: If district maintenance staff complete the plumbing, labor time may not have to be figured.

EST. TIME ______________

WORKSHEET # 4.5

HEATING (REMODELING)

PURPOSE: In most remodeling situations, major changes of the heating system will not be required. Hot water heating may have to be changed if it takes up a large amount of wall space. Thermostats may need relocating and this usually requires a professional heating man.

COLOR CODING: None

VENDOR I.D. #: 20, 41

BILL OF MATERIAL: Pencil in the needed information to complete the section on heating.

TASK	DESCRIPTION OF TASK	COST

MATERIAL COST: Add up the cost column and enter total cost.

EST. COST ______________

TIME: Use district maintenance staff to help determine time.

EST. TIME ______________

WORKSHEET # 4.6

FLOORS (REMODELING)

PURPOSE: Here, again, the repairing of floors is minor repair work in most cases. Following is a list of considerations:

1. Painting or repainting certain areas of the floor.
2. Applying non-skid material around danger areas.
3. Patching of floors after relocation of equipment.
4. Patching of floors after wall section removal.
5. Patching of floors after removal or addition of electrical wiring.

COLOR CODING: None

VENDOR I.D. #: 20, 36

BILL OF MATERIAL: List the tasks, descriptions of tasks, and costs in the space below. The district maintenance department may help you determine the needed tasks and costs.

TASK	DESCRIPTION OF TASK	COST
Non-skid material		
Painting or repainting		
Patching floor		

MATERIAL COST: Add up the cost column and enter total cost.

EST. COST ________________

TIME: Use district maintenance staff to help you determine time.

EST. TIME ________________

WORKSHEET # 4.7

CEILING (REMODELING)

PURPOSE: The repairing of ceilings in a shop is normally a minor job. The following should be considered:

1. If you add electrical drop cords, some ceiling tile will need replacing.
2. The installation or relocating of a hood or snorkel will require ceiling work.
3. If you remove wall sections, ceiling work will be required.
4. Possible painting or cleaning of ceiling tile will need to be completed before your new program begins.
5. Check with the Fire Marshall to be sure planned construction conforms to building codes.

COLOR CODING: None

VENDOR I.D. #: 20, 41

BILL OF MATERIAL: With help from other staff members or district maintenance, fill in the needed information.

TASK	DESCRIPTION OF TASK	COST
Painting		
Replace Ceiling Tile		
Roof Repair		

MATERIAL COST: Add up the cost column and enter total.

EST. COST ________________

TIME: Here, again, the district maintenance staff may help you determine the time required to complete the tasks.

EST. TIME ________________

WORKSHEET # 4.8

EQUIPMENT RELOCATION (REMODELING)

PURPOSE: Some of the costs of equipment relocation are mentioned in worksheet 4.6 on floors. Additional things to consider will be the time required to move and fasten down equipment.

COLOR CODING: None

VENDOR I.D. #: 20, 36

BILL OF MATERIAL: Pencil in the needed information.

TASK	DESCRIPTION OF TASK	COST
Relocating Equipment		
Fastening Equipment to Floor		

MATERIAL COST: Hardware may be the only expense to complete the tasks.

EST. COST ____________

TIME: Use other staff members and district maintenance people to help you determine time.

EST. TIME ____________

WORKSHEET # 4.9

GENERAL (REMODELING)

PURPOSE: This worksheet deals with all the little odd jobs that haven't been mentioned before. You could call this the nuts & bolts worksheet. We will mention as many things as possible but it is impossible to list everything. Read through the following considerations.

1. Cleaning and painting before starting program.
2. Relocation of existing casework and placement of new casework and furniture.
3. Repairing or redesigning of existing casework and furniture.
4. Removing caulk boards, bulletin boards, window blinds, clocks, etc.
5. Ordering nuts, bolts, screws, pop rivets, paints, contact cement and necessary hardware required to facilitate setting up the program.

COLOR CODING: None

VENDOR I.D. #: 20, 36, 37, 38

BILL OF MATERIAL: List as many tasks as possible to think of, and fill in the description and cost columns. Help from other staff members and district maintenance people will help you determine your costs.

TASK	DESCRIPTION OF TASK	COST

MATERIAL COST: Add up the cost column and enter total cost.

EST. COST ________________

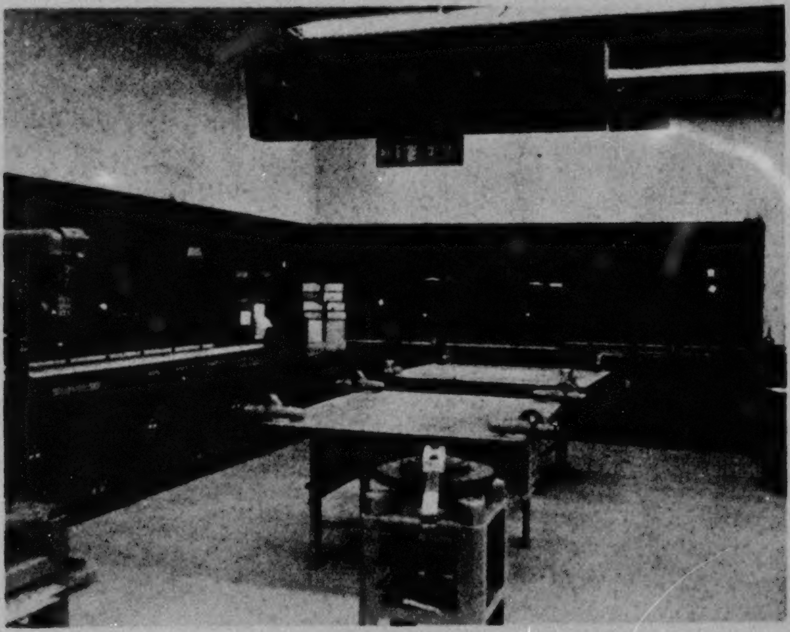
TIME: Look at your list of tasks and estimate the number of hours you will need to complete the tasks.

EST. TIME ________________

WORKSHEET # 5

CASEWORK LIST

PURPOSE: This suggested list should help you finish the inventory of your casework on hand and give you an idea of what needs to be ordered. The number of workbenches listed would accomodate 75 students per period. To get a better idea of the number of workbenches required, look at your floor plan design. The other items listed will be required in any size shop if you include the activity area they would be found in.



COLOR CODING: Workbenches - paint the bases the activity area color or a base green. Other Items - paint activity area color where items are located.

VENDOR I.D. #: 7, 13, 32, 34, 47, 61, 62

BILL OF MATERIAL: Pencil in the appropriate columns, the number to order, the supplier's name and cost of the item.

ON HAND	NO. REQ.	ITEM	TO ORDER	SUPPLIER	COST
		WORKBENCHES			
	4	Woods Area			
	2	Plastics Area			
	1	Crafts Area			
	1	Power Mechanics Area			
	2	Cold Metals Area			
	2	Hot Metals Area			

ON HAND	NO. REQ.	ITEM	TO ORDER	SUPPLIER	COST
	1	Plywood Rack			
	1	Lumber Storage			
	1	Bar Clamp Rack			
	1	Hand Clamp Rack			
	1	Sheet Metal Storage			
	1	Bar Stock Storage			
	1	Sheet Plastic Storage			

CASEWORK COST:

EST. COST ______________

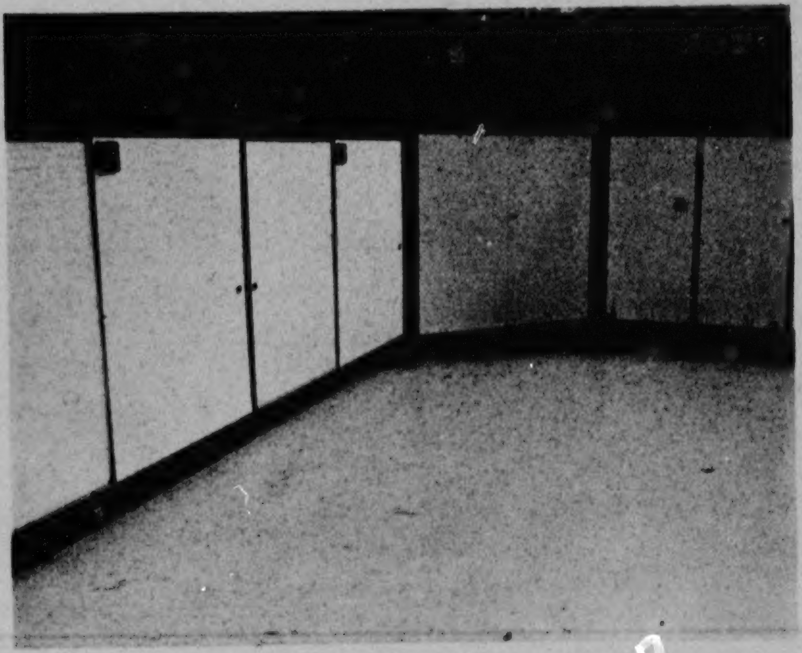
TIME: To order needed casework and storage units (2 hours).

EST. TIME ______________

WORKSHEET # 6

CASEWORK CONSTRUCTION PLANS

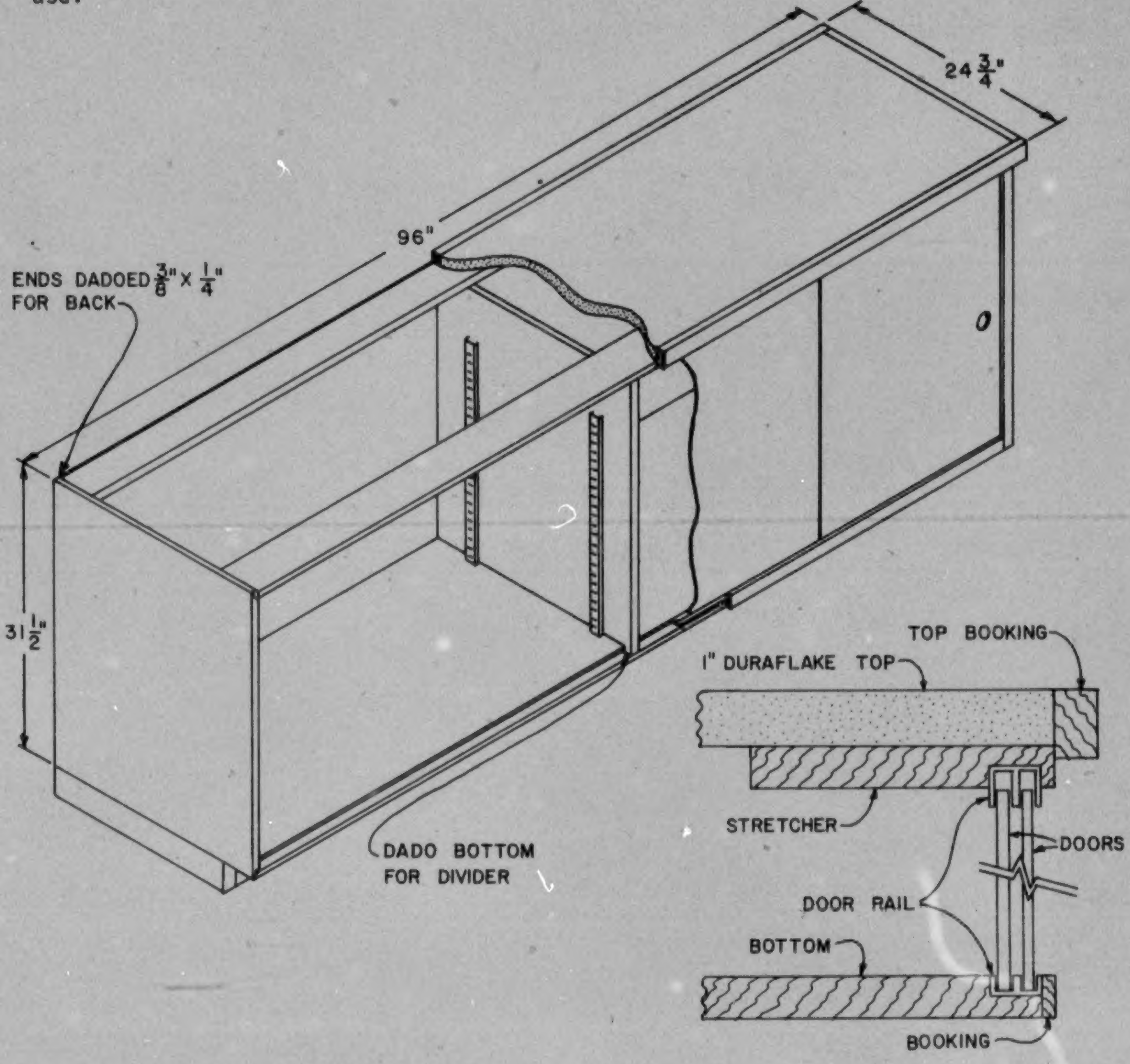
PURPOSE: You may have determined in Step 1 of Section 3: Furnishing and Installation (page 48) that you would prefer to build some of the needed casework. The following worksheets provide you with sketches and bills of material for 8' cabinets, 4' cabinets with doors, 4' cabinets with sliding doors, corner cabinets, and small engine storage cabinets.



WORKSHEET # 6.1

8' CABINETS

PURPOSE: The 8' cabinet is built with two sections of sliding doors. The main function of this type of cabinet is student project storage. The one-inch thick top also makes the cabinet a good work station for students. The cabinet is free standing to allow for future design changes within the shop. Color coding of the cabinet is accomplished by painting the sliding doors the different area colors. Enlarging or reducing an area size is accomplished by simply repainting the cabinet fronts so that more or fewer cabinets can be identified with one activity area or the other. A stencil and paint are used to mark the class period number on the cabinet fronts so that each class period has ample project storage. Similar numbered cabinets are also keyed alike so only the cabinets that correspond to the class in session are open for student use.


24 3/4"
96"
ENDS DADOED 3/8" x 1/4" FOR BACK
31 1/2"
DADO BOTTOM FOR DIVIDER
TOP BOOKING
1" DURAFLAKE TOP
STRETCHER
DOORS
DOOR RAIL
BOTTOM
BOOKING

SLIDING DOOR DETAIL

COLOR CODING: Paint the sliding doors the activity area color (Worksheet 9).

VENDOR I.D. #: 20, 21, 34, 49

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
2	Ends	3/4"	23 3/4"	31 1/2"	Fir Plywood
1	Divider	3/4"	23 1/2"	30 3/8"	Fir Plywood
1	Bottom	3/4"	23 1/2"	96"	Fir Plywood
1	Back	1/4"	31 1/2"	96"	Masonite
4	Doors	1/4"	30 1/4"	24"	Masonite
1	Top	1"	23 1/4"	95 1/4"	Duraflake
1	Top Bk. Strip	3/4"	1"	96 3/4"	Alder
1	Top Bk. Strip	3/4"	1 1/2"	96 3/4"	Alder
2	Top Bk. Strip	3/4"	1"	23 1/4"	Alder
1	Front Bk. Strip	1/4"	3/4"	96 3/4"	Alder
3	Front Bk. Strip	1/4"	3/4"	30"	Alder
2	Stretchers	3/4"	5 1/2"	96"	Fir
2	F & B Base	1 1/2"	3 1/2"	93 3/4"	Fir
2	End Base	1 1/2"	3 1/2"	21"	Fir
1	Center Base	1 1/2"	3 1/2"	18"	Fir
1	Upper Rail	11/16"	13/16"	47 1/4"	Plastic
1	Lower Rail	1/4"	13/16"	47 1/4"	Plastic
8	Shelf Std.	3/16"	1/2"	24"	Metal
2	Shelf	3/4"	22"	46 3/4"	Fir Plywood
2	Shelf Bk.	1/4"	3/4"	46 3/4"	Alder

MATERIAL COST:

Number required ____________ @ Cost ____________ = EST. COST ______________

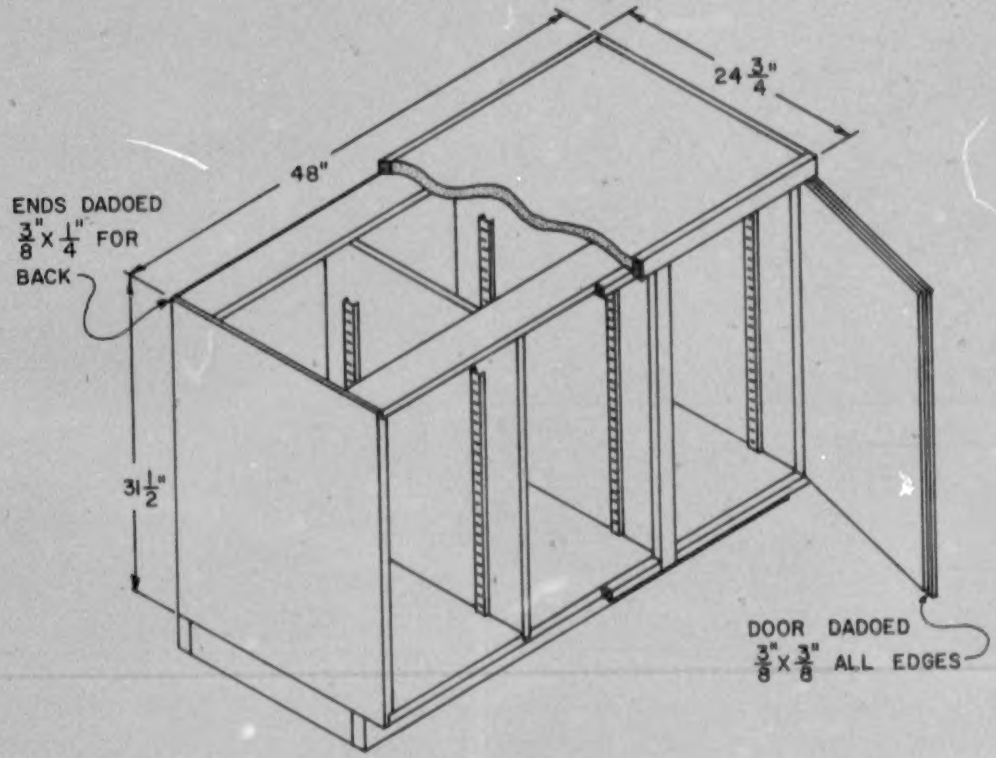
TIME: To build, finish and color code 8' cabinets (8 hours per cabinet).

Number required __________ X 132 hour = EST. TIME ______________

WORKSHEET # 6.2

4' CABINET WITH DOORS

PURPOSE: Two styles of cabinet can be built, sliding door or three door. The sliding door type is used for storage of bulk material and student projects. Tote-trays are built into the three-door cabinets. Small item storage is best suited for this cabinet design. They can be locked or left unlocked so students can select material for their shop work.


48"
24 3/4"
ENDS DADOED 3/8" x 1/4" FOR BACK
31 1/2"
DOOR DADOED 3/8" x 3/8" ALL EDGES

COLOR CODING: This, again, is accomplished by painting the door fronts.

VENDOR I.D. #: 20, 21, 34, 39

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
2	Ends	3/4"	23 1/4"	31 1/2"	Fir Plywood
2	Dividers	3/4"	23"	30 3/8"	Fir Plywood
1	Bottom	3/4"	23"	47 1/4"	Fir Plywood

# PCS.	NAME	T	W	L	MATERIAL
3	Doors	3/4"	15 1/4"	30 3/4"	Fir Plywood
1	Back	1/4"	31 1/2"	47 1/4"	Masonite
1	Top	1"	23 1/4"	46 1/2"	Duraflake
1	Top Bk. Strip	3/4"	1 1/4"	48"	Alder
2	Top Bk. Strip	3/4"	1"	23 1/4"	Alder
1	Top Bk. Strip	3/4"	1"	48"	Alder
2	Front Bk. Strip	3/4"	1 1/4"	31 1/2"	Alder
2	Front Bk. Strip	3/4"	1"	31 1/2"	Alder
6	Front Bk. Strip	3/4"	3/4"	14 1/2"	Alder
2	Stretchers	3/4"	5 1/2"	47 1/4"	Fir
2	F & B Base	1 1/2"	3 1/2"	48"	Fir
2	End Base	1 1/2"	3 1/2"	18"	Fir
1	Center Base	1 1/2"	3 1/2"	18"	Fir
12	Shelf Std.	3/16"	1/2"	24"	Metal
9	Shelf	3/4"	22"	14 1/2"	Fir Plywood
9	Shelf Bk.	1/4"	3/4"	14 1/2"	Alder

MATERIAL COST:

Number required ______________ @ Cost ______________ EST. COST ______________

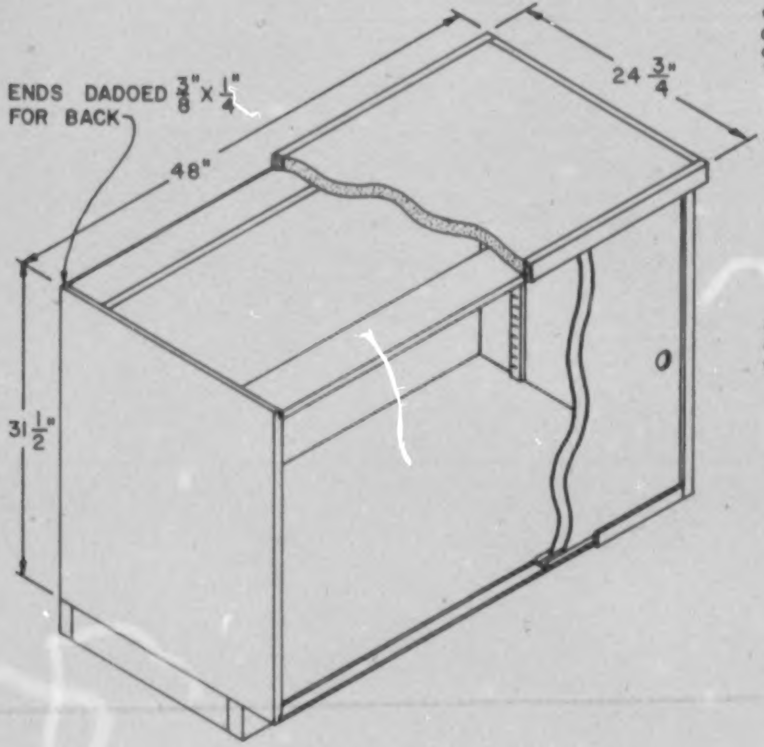
TIME: To construct, finish and color code cabinets (7 hours per cabinet).

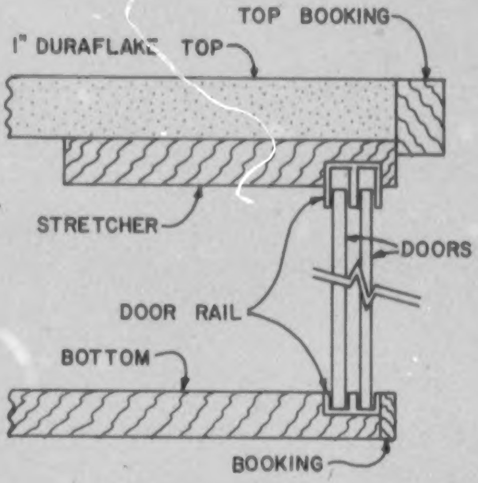
Number required ____________ X ________ hour = EST. TIME ______________

WORKSHEET # 6.3

4' CABINET WITH SLIDING DOORS

PURPOSE: Two styles can be built, sliding door or three door. The sliding door type is used for storage of bulk material and student projects.


ENDS DADOED 3/8" X 1/4" FOR BACK
48"
24 3/4"
31 1/2"


TOP BOOKING
1" DURAFLAKE TOP
STRETCHER
DOORS
DOOR RAIL
BOTTOM
BOOKING

SLIDING DOOR DETAIL

COLOR CODING: Paint the sliding doors the activity area color (Worksheet 9).

VENDOR I.D. #: 20, 21, 34, 49

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
2	Ends	3/4"	23 3/4"	31 1/2"	Fir Plywood
1	Bottom	3/4"	23 1/2"	47 1/4"	Fir Plywood
1	Back	1/4"	31 1/2"	47 1/4"	Masonite
2	Doors	1/4"	30 1/4"	24"	Masonite
1	Top	1"	23 1/4"	46 1/2"	Duraflake

# PCS.	NAME	T	W	L	MATERIAL
1	Top Bk. Strip	3/4"	1 1/4"	48"	Alder
2	Top Bk. Strip	3/4"	1"	23 1/4"	Alder
1	Top Bk. Strip	3/4"	1"	48"	Alder
1	Front Bk. Strip	1/4"	3/4"	48"	Alder
2	Front Bk. Strip	1/4"	3/4"	30	Alder
2	Stretchers	3/4"	5 1/2"	47 1/4"	Fir
2	F & B Base	1 1/2"	3 1/2"	48"	Fir
2	End Base	1 1/2"	3 1/2"	18"	Fir
1	Center Base	1 1/2"	3 1/2"	18"	Fir
1	Upper Rail	11/16"	13/16"	46 1/2"	Plastic
1	Lower Rail	1/4"	13/16"	46 1/2"	Plastic
4	Shelf Std.	3/16"	1/2"	24"	Metal
1	Shelf	3/4"	22"	46"	Fir Plywood
1	Shelf Bk.	1/4"	3/4"	46"	Alder

MATERIAL COST:

Number Required ________________ @ Cost ____________ EST. COST ________________

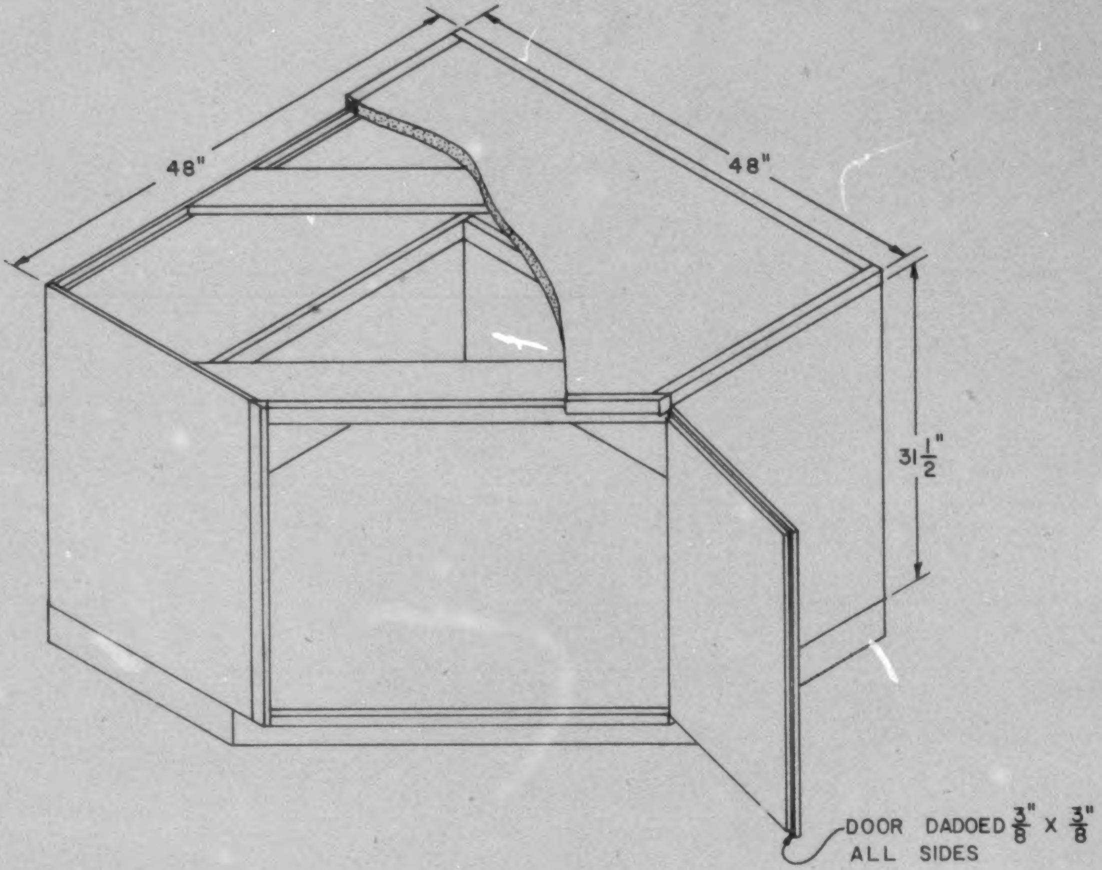
TIME: To construct, finish and color code (6 hours per cabinet).

Number Required ________________ @ Time ____________ EST. TIME ________________

WORKSHEET # 6.4

CORNER CABINETS

PURPOSE: This style gives flexibility and saves valuable floor space when there is a need to place casework around corners. Content area can be isolated and extended outward into the center of the facility with this type of cabinet. Because corner cabinets are large they provide space for large bulk storage.



COLOR CODING: Paint the door fronts the activity area color where the cabinets are located (Worksheet 9).

VENDOR I.D. #: 20, 21, 34, 49

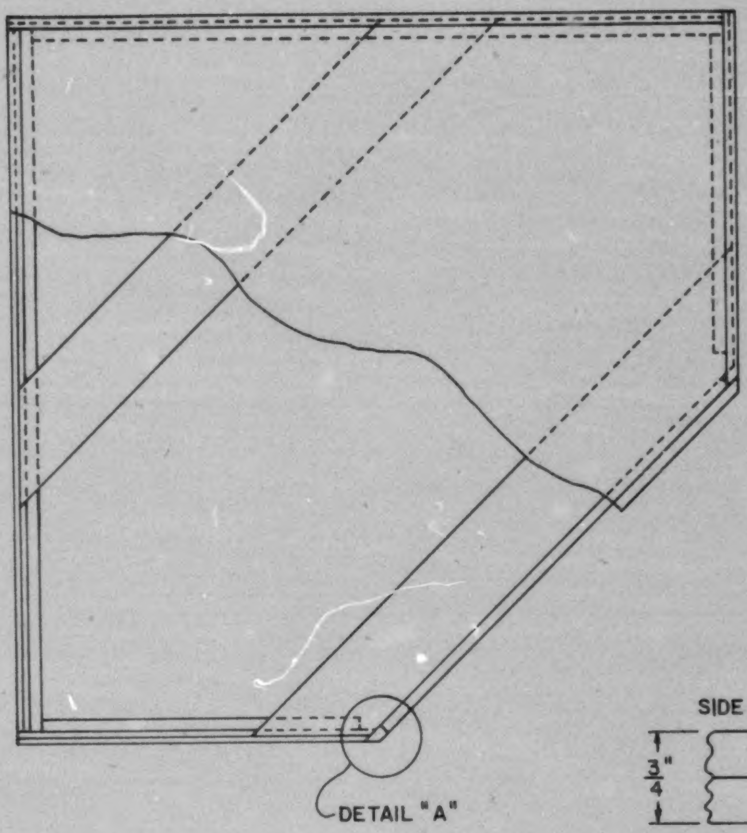
BILL OF MATERIALS:

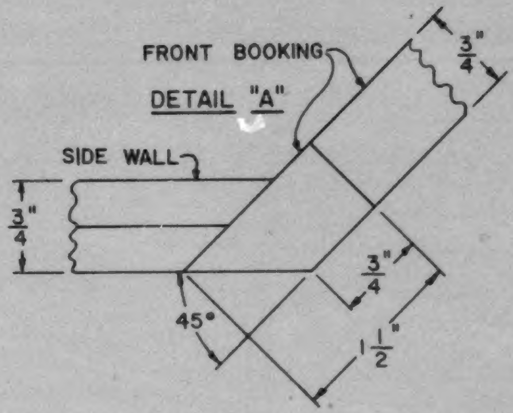
# PCS.	NAME	T	W	L	MATERIAL
1	Back	3/4"	31 1/2"	47 1/4"	Fir Plywood
1	Back	3/4"	31 1/2"	46 1/2"	Fir Plywood
2	Sides	3/4"	23 11/16"	31 1/2"	Fir Plywood

# PCS.	NAME	T	W	L	MATERIAL
1	Top	1"	46 1/2"	46 1/2"	Duraflake
1	Top Bk. Strip	3/4"	1"	47 1/4"	Alder
1	Top Bk. Strip	3/4"	1"	45 1/2"	Alder
2	Top Bk. Strip	3/4"	1"	25"	Alder
1	Top Bk. Strip	3/4"	1 1/4"	32 1/2"	Alder
1	Front Bk. Strip	3/4"	3/4"	32 1/2"	Alder
1	Front Bk. Strip	3/4"	1 1/2"	32 1/2"	Alder
2	Front Bk. Strip	3/4"	1 1/2"	31 1/2"	Alder
2	Doors	3/4"	16 5/8"	30 3/4"	Fir Plywood
1	Bottom	3/4"	46 1/2"	46 1/2"	Fir Plywood
1	Shelf	3/4"	46 1/2"	46 1/2"	Fir Plywood
1	Shelf Cleat	3/4"	1 1/2"	46 1/2"	Fir
1	Shelf Cleat	3/4"	1 1/2"	45 3/4"	Fir
2	Shelf Cleats	3/4"	1 1/2"	21"	Fir
2	Stretchers	3/4"	5 1/2"	45 1/2"	Fir
1	Base	1 1/2"	3 1/2"	46 1/2"	Fir
1	Base	1 1/2"	3 1/2"	45"	Fir
1	Base	1 1/2"	3 1/2"	40 1/2"	Fir
2	Base	1 1/2"	3 1/2"	33"	Fir

WORKSHEET # 6.4 (continued)

CORNER CABINETS




FRONT BOOKING
DETAIL "A"
SIDE WALL
3/4"
3/4"
3/4"
45°
1 1/2"

MATERIAL COST:

Number Required ______________ @ Cost ___________ EST. COST ________________

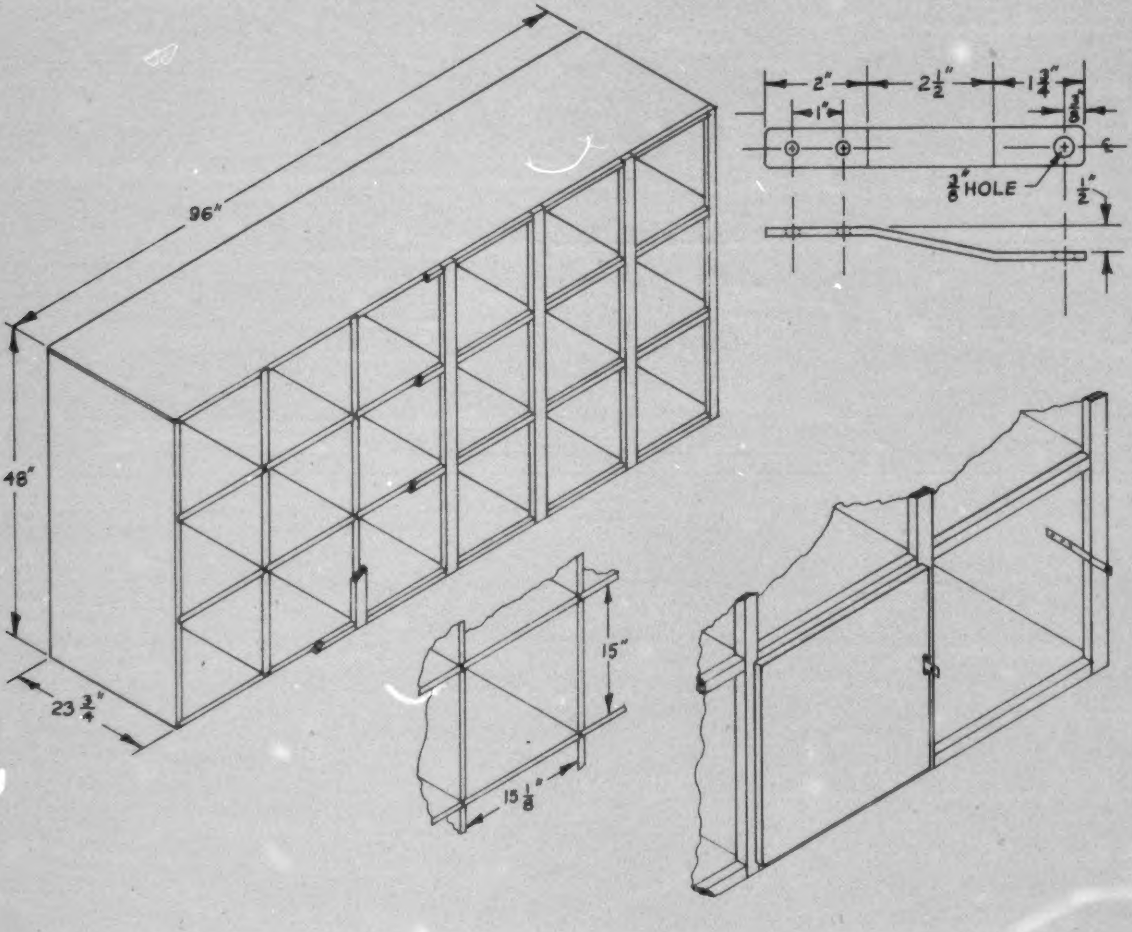
TIME: To build, finish and color code corner cabinets (9 hours per cabinet).

Number Required ______________ @ Time ___________ EST. TIME ________________

WORKSHEET # 6.5

SMALL ENGINE STORAGE CABINET

PURPOSE: To provide space for storage of 18 small engines that students can bring from home to work on in the shop. Space is provided for 18 small engines. Students can bring their own lock from home to insure the safe-keeping of their engine. When they have completed work on their engine, they must remove the lock and take their engine home. It is the student's responsibility to care for storage of their engines.



COLOR CODING: Paint Power Mechanics Area Color

VENDOR I.D. #: 20, 21, 34, 49

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
2	Top and Bottom	3/4"	23 3/4"	96"	Fir Plywood
2	Sides	3/4"	23 3/4"	47 1/4"	Fir Plywood
5	Verticals	3/4"	23 1/2"	47 1/4"	Fir Plywood
12	Shelves	3/4"	23 1/2"	15 5/8"	Fir Plywood
1	Back	1/4"	47 1/4"	95 1/4"	Masonite
18	Doors	3/4"	15 1/4"	15 1/2"	Fir Plywood
24	Hort. Booking	3/4"	3/4"	14 5/8"	Alder
5	Vert. Booking	3/4"	1 1/4"	48"	Alder
2	End Booking	3/4"	1"	48"	Alder
18	Hasps	1/8"	3/8"	6 1/4"	Flat Iron
36	Hinges				

MATERIAL COST:

Number Required ____________ @ Cost ______________ EST. COST ________________

TIME: To construct and color code engine storage cabinet (8 hours).

EST. TIME ______________

WORKSHEET # 7

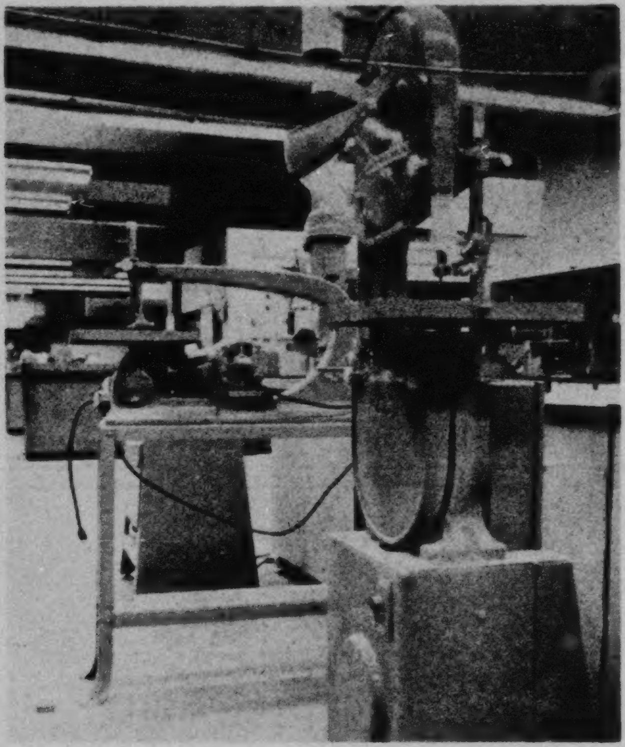
EQUIPMENT LISTS

PURPOSE: Suggested equipment lists for each of the activity areas are presented on the following pages. The sheets may be used to note the equipment for each area you may already have on hand, the number required (or considered desirable), the number you will need to order to meet your needs, the supplier of that particular piece of equipment, and its estimated cost.

WORKSHEET # 7.1

WOODS EQUIPMENT LIST

PURPOSE: This is a suggested equipment list for the woods area. The first thing to do is check the (on hand) column. If you have a piece of equipment that is not on the list, add it in the (description) column. If you need to order equipment, put a check in the (to order) column. This worksheet may serve as an inventory list to be filed away.



COLOR CODING: See Worksheet 12.11.

VENDOR I.D. #: 3, 5, 7, 13, 22, 24, 49, 55, 62

BILL OF MATERIAL: Using the latest catalogs, go through the list and fill in supplier and cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Band Saw 14" Fence/Miter Gauge			
	1	Drill Press 15" - 2 3/4" Columntilting table & Hold-down clamp			
	1	Uniplane 6" miter gauge			
	2	Lathe standard 12" variable speed			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Saw-scroll 24" (No vari-speed)			
	1	6" belt & 12" disc sander with miter gauge			
	1	Saw-table 10" tilting arbor Miter gauge & Brett Guard			
	1	Tool Grinder			
	1	Saw-Saber			
	1	Sander-Vibrator			
	2	Sander - Belt 3" x 21"			
	2	Router 1 hp with guide			
	1	Drill Electric 3/8"			
	1	Miter Box with Saw			

EQUIPMENT COST:

EST. COST__________________

TIME: To order woods equipment (3 hours).

EST. TIME__________________

WORKSHEET # 7.2

COLD METALS EQUIPMENT LIST

PURPOSE: Read through this suggested equipment list and note the equipment on hand and list what needs to be ordered.

COLOR CODING: Order your equipment base color green (see Worksheet 12.11).

VENDOR I.D. #: 3, 5, 7, 13, 22, 55, 61, 62

BILL OF MATERIAL: Pencil in the supplier and cost of the items you will need to order.

ON HAND	NO. REQ.	DESCRIPTION	ORDER	SUPPLIER	COST
	1	Sander/Grinder with guards			
	1	Bench Grinder 6" with shields			
	1	Buffer 6", ½ h.p. eye shields (bench mounted)			
	1	Saw, horizontal power hack			
	1	Drill press 15" tilting table & holddown clamp			
	1	Lathe, metal			
	1	Bender with stand			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Box & Pan Brake with stand			
	1	Slip Roll with stand			
	1	Beverly Shear			
	1	Vise 5"			
	1	Shear, Foot squaring			

EQUIPMENT COST:

EST. COST ________________

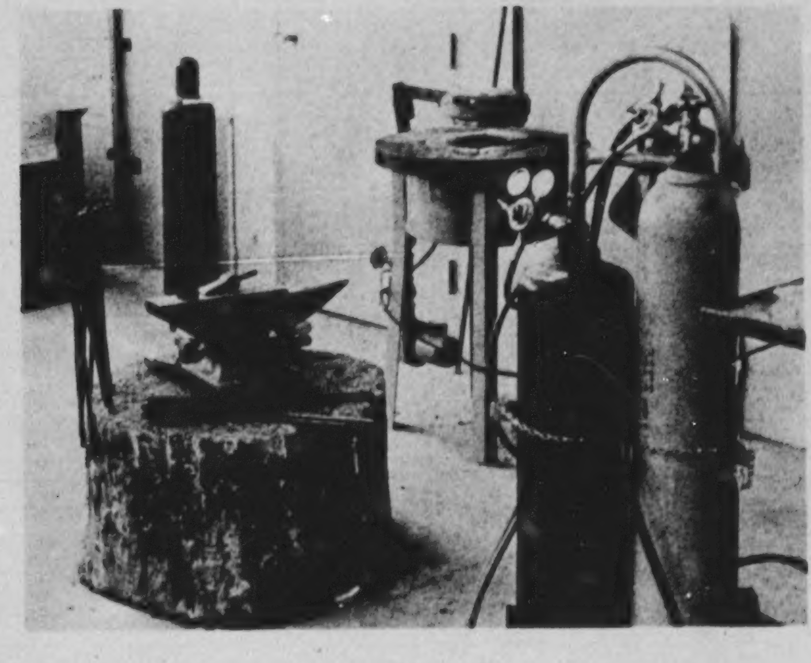
TIME: To order equipment (2 hours).

EST. TIME ________________

WORKSHEET # 7.3

HOT METALS EQUIPMENT LIST

PURPOSE: This is just a suggested equipment list for a Hot Metals area. Read through the list and note the equipment you have on hand and what you will need to order. You may need to add additional equipment in the (Description) column.



COLOR CODING: Order your equipment with a base color green rather than the traditional gray color (See Worksheet 12.11).

VENDOR I.D. #: 7, 13, 22, 31, 42, 55, 62, 65

BILL OF MATERIAL: Fill in the supplier of your choice and the cost of the item. Keep in mind that you are ordering equipment for students and not instructors. Use the list on the back page to check off your equipment when it is delivered.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Arc Welder 180 AMP			
	2	Oxy-acetylene set up			
	2	Truck - cylinder			
	1	Spot welder, portable w/tongs			
	1	Heat treating furnace with pedestal support, with safety system			

ON HAND	NO REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Crucible Furnace with safety system			
	1	Soldering furnace			
	1	Foundry Tools #10			
	1	Moulding Bench			
	1	Welding booth - combination arc & gas			

EQUIPMENT COST:

EST. COST ________________

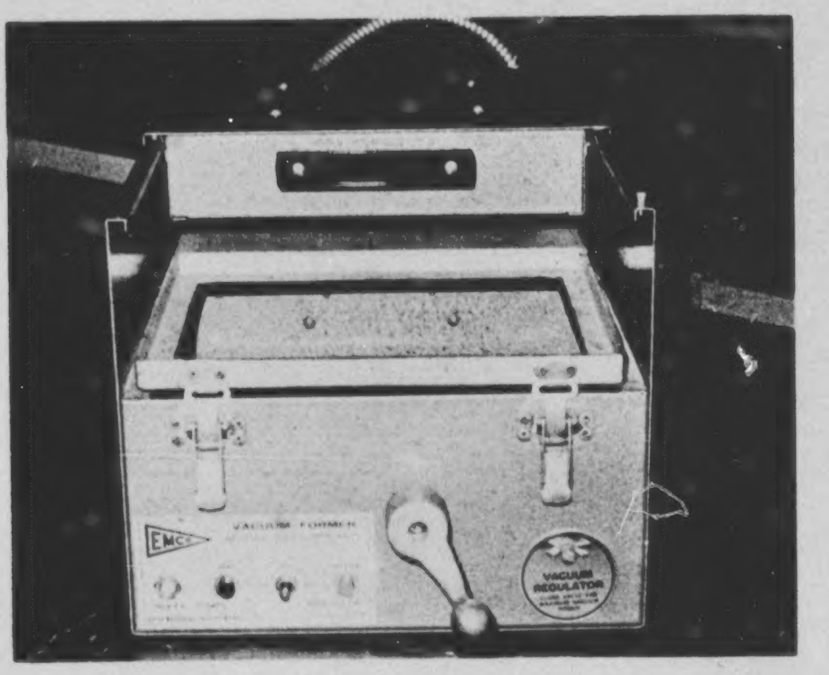
TIME: To select equipment and make out purchase order (2 hours)

EST. TIME ________________

WORKSHEET # 7.4

PLASTICS EQUIPMENT LIST

PURPOSE: If your Plastics area has all of the suggested equipment listed on this page, you will have a very good activity area for students. Xerox a couple sheets of the list and use them for your ordering form and inventory list.



COLOR CODING: Specify on your order that you wish a base color green on all equipment, if possible (see Worksheet 12.11).

VENDOR I.D. #: 7, 15, 18, 26, 28, 61, 62

BILL OF MATERIALS: Fill in the supplier of your choice and the cost of the item.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	6" Buffer, ½ h.p., eye shield (bench mounted)			
	1	Heat Gun			
	1	Sander/Grinder with guards			
	1	Range, 4 burner w/30" oven			
	1	Vacuum former w/assorted molds			
	1	Injection molder w/assorted molds			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Heater, Strip 30"			
	1	Air Compressor, 1 h.p. with 25' of air hose			
	1	Fiberglass chopper, hand held			
	1	Fiberglass spray coating gun assorted nozzles			
	1	Plastisol molding kit			
	1	Plastic welding torch			
	1	Saw - scroll 24" (no vari-speed)			
	1	Saw - saber			
	1	Drill - Electric 3/8"			
	1	Moto Tool (Dremel)			

EQUIPMENT COST:

EST. COST ____________

TIME: To order equipment (2 hours).

EST. TIME ____________

WORKSHEET # 7.5

CRAFTS EQUIPMENT LIST

PURPOSE: Only one piece of equipment has been listed because most of the work in crafts is accomplished with hand tools. Add to this list if you have or need additional equipment.

COLOR CODING: See worksheet 12.11.

VENDOR I.D. #: 2, 7, 16, 58, 62

BILL OF MATERIAL: Pencil in the supplier and item cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Kiln			

EQUIPMENT COST:

EST. COST ________________

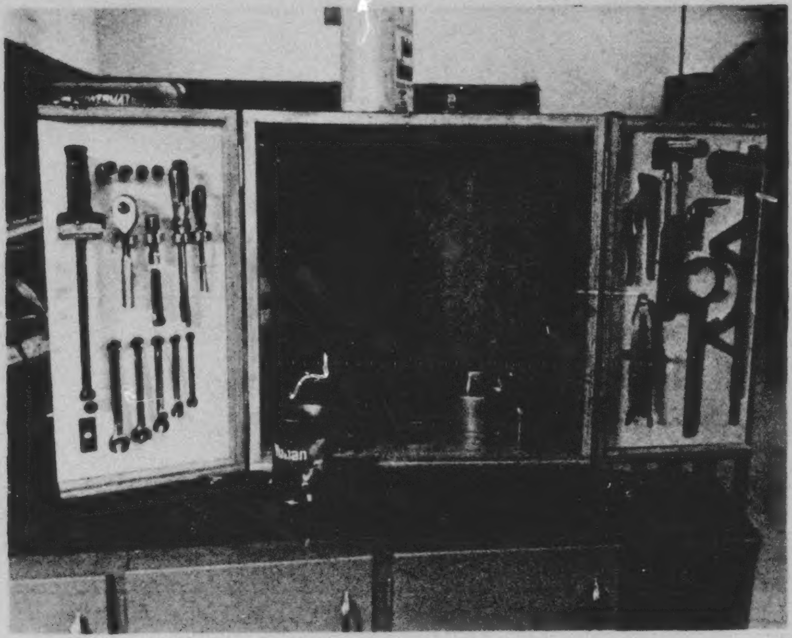
TIME: To order craft equipment (½ hour)

EST. TIME ________________

WORKSHEET # 7.6

POWER MECHANICS EQUIPMENT LIST

PURPOSE: This suggested equipment list will help you set up a good Power Mechanics area. If you need more equipment, add to this list the name of the item.



COLOR CODING: See Worksheet 12.11

VENDOR I.D. #: 7, 8, 41, 53, 61, 62

BILL OF MATERIAL:

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Small motor tool panel with cylinder hone			
	1	Safety parts washer #434913 Model #2R			
	1	Small engine test stand			
	1	Engine - Briggs & Stratton 4 cycle, 2 HP with manual			
	1	Engine, Honda (4 cycle)			
	1	Engine, Motorcycle (2 cycle)			

TO HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Valve seat grinding set			
	1	Valve refacing lathe			
	1	Magneto ignition analyzer			

EQUIPMENT COSTS:

EST. COST ________________

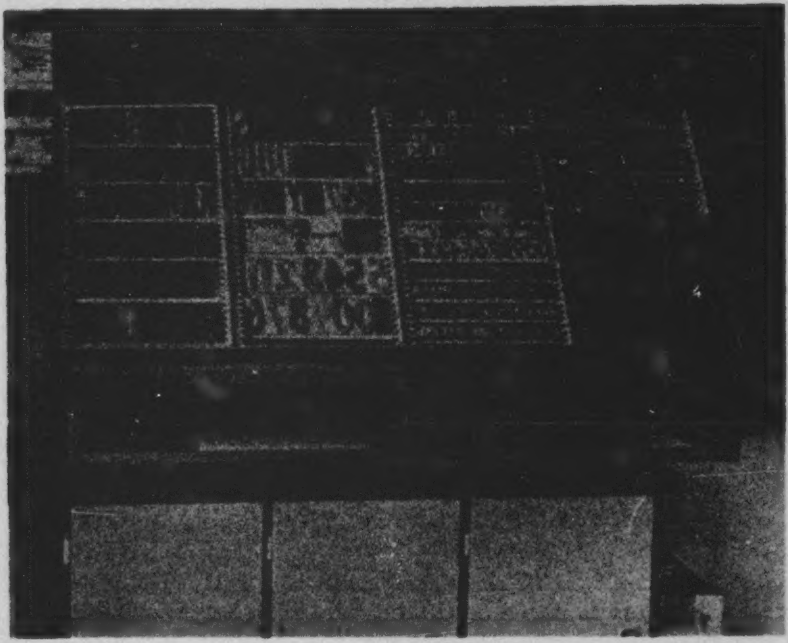
TIME: To order equipment (1 hour)

EST. TIME ________________

WORKSHEET # 7.7

GRAPHICS EQUIPMENT LIST

PURPOSE: Read through this suggested equipment list and note the equipment on hand. Check what needs to be ordered.



COLOR CODING: See Worksheet 12.11.

VENDOR I.D. #: 7, 61

BILL OF MATERIAL: Pencil in the supplier and cost of the items you will need to order.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Rubber Stamp Press w/supply kit			
	1	Engraving machine			
	1	Sign machine (proof press w/fonts & supplies)			
	2	Silk screen printing kits			
	1	Block printing kit			

EQUIPMENT COST

EST. COST ________________

TIME: To order graphics equipment (1 hour)

EST. TIME ________________

WORKSHEET # 7.8

GENERAL INDUSTRIES EQUIPMENT LIST

PURPOSE: This is a suggested equipment list for the General Industries area. If you do not have a Woods area planned for your facility, you will need to add more equipment to this list.

COLOR CODING: Order your equipment with a base color green rather than the traditional gray color (See Worksheet 12.11).

VENDOR I.D. #: 7, 53, 62

BILL OF MATERIAL: Fill in the supplier of your choice and the cost of the item.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Saw - 10" radial w/leaf guards			
	1	Drill - electric ½"			
	1	Saw - Circular 6 3/4"			
	1	Saw - Sabre			
	1	Sander - Belt 4" x 21" with dust collector			

EQUIPMENT COST:

EST. COST ______________

TIME: To order equipment (1 hour)

EST. TIME ______________

WORKSHEET # 7.9

ELECTRICITY/ELECTRONICS EQUIPMENT LIST

PURPOSE: This is a suggested Electricity/Electronics equipment list. Add to this list if you have more equipment on hand than what is listed.

COLOR CODING: See Worksheet 12.11.

VENDOR I.D. #: 7, 35, 61

BILL OF MATERIAL: Using the latest catalogs, read through this list and fill in the supplier and costs.

ON HAND	NO REQ	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	VOM - FET 10 MEG OHM/V			
	1	Power supply - DC, regulated 0-24V			
	2	Soldering pencil 40 watt			
	1	Soldering gun 100/140 watts			
	1	Soldering gun 240/325 watts			
	1	Drill - electric 3/8"			

EQUIPMENT COST:

EST. COST ____________

TIME: To order equipment (1 hour)

EST. TIME ____________

WORKSHEET # 8

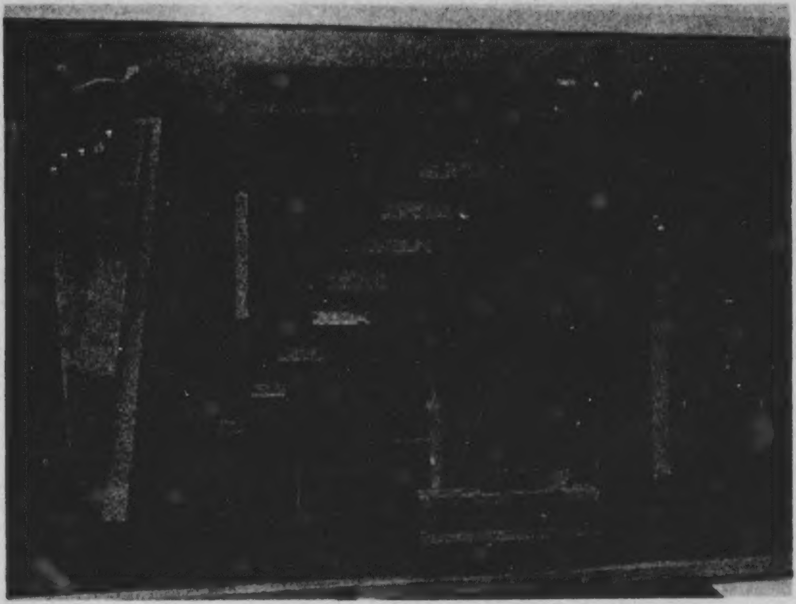
HAND TOOL LIST

PURPOSE: This worksheet provides you with lists of hand tools and small equipment you will need to furnish each activity area. The lists are set up so you can easily inventory what you have on hand and what you will need to order. Space is provided to note suppliers of tools you will need to purchase and estimated costs. These sheets can serve as permanent inventory records.

WORKSHEET # 8.1

WOOD HAND TOOL LIST

PURPOSE: This is a suggested tool list for the Woods area. Check the appropriate columns to see what needs to be ordered. If you xerox the list, you can use it as an order form.



COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 3, 7, 13, 24, 62

BILL OF MATERIAL: Fill in the supplier and costs.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	2	Awl, Scratch 6"			
	1	Bevel-T, 8" sliding			
	1	Gauge, Marking			
	1	Set, Auger Bits #4 through #16			
	1	Bit, Expansion #2			
	2	Braces 8"			
	4	Brushes - Utility 8"			
	1	Router Bit Set (Carbide when possible)			
		Straight ¼" & ½"			
		V Groove			
		Bead			
		Corner Round			
		Core Box ¼"			
		Cove			
		Veining			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Chisel ¼"			
	1	Chisel 3/8"			
	3	Chisel ½"			
	1	Chisel 5/16"			
	2	Chisel 3/4"			
	1	Chisel 1"			
	1	Chisel 1¼"			
	2	Cord - Estension 25 feet			
	2	Knife - Putty			
	3	Knife - Utility 6" adjustable			
	1	Level - 24' Steel			
	2	Mallet - Wood 2¼" Dia.			
	2	Planes - Block 6"			
	2	Planes - Smooth 9"			
	2	Planes - Jack 14"			
	4	Rules 24" Steel			
	4	Rules 12" Steel			
	2	Squares - Tri 8"			
	2	Squares - Combination (no level 12")			
	2	Squares - Framing 12" steel			
	1	Framing - Squares 24" steel			
	1	Screw Driver Set 7 pc. min. inc. Phillips			
	2	Scrapers - Hand 2½"			
	1	Gun, Staple			
	1	Cutter, 7" Diagonal			
	2	Pliers, Slip Joint 6"			
	1	Countersink			
	2	Stones, Silicone carbide combination 6 x 2 x 1			
	1	Stone Slip			
	1 ea.	Drill - Multi Spur			
		1/2"			
		9/16"			
		5/8"			
		11/16"			
		3/4"			
		13/16"			
		7/8"			
		15/16"			
		1"			
		1 1/8"			
		1 1/4"			
		1 3/8"			
		1 1/2"			
		1 5/8"			
		1 3/4"			
		1 7/8"			
		2"			

WORKSHEET # 8.1 (Continued)

WOODS HAND TOOL LIST

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Drill Set - Twist 1/16" through ½" by 64th			
	1	Dowel Jig Model A			
	1	Dowel Center Kit #888			
	1	Cutter - Plug #1523 3/8" (Stanley)			
	1	Cutter - Plug #1523 1/2" (Stanley)			
	1	Cutter - Plug #1523 5/8" (Stanley)			
	1	Cutter - Circle			
	8	Clamp - Corner			
	2	Clamp - Pony Band			
	6	Clamp - 1 Bar #7024 Jorgensen			
	6	Clamp - 1 Bar #7030 Jorgensen			
	6	Clamp - 1 Bar #7036 Jorgensen			
	6	Clamps, Spring			
	6	Hand Screws - 4½"			
	6	Hand Screws - 6"			
	6	Hand Screws - 8¼"			
	3	Files - Surform 10"			
	2	Files - Surform 10" Round			
	2	Files, Rasp 10" Half Round			
	2	Files, Rasp 10" Round			
	2	Files, Half-Round 10"			
	2	Files, Round 2nd Cut 10"			
	12	File handles #3			
	2	File Cards 4"			
	1	Hammer - Upholsterers' 5½" 7 oz.			
	2	Hammers - Claw 13 oz.			
	1	Set - Nail			
	1	Saw - Hack Adjustable			
	2	Saw - Rip 26", 5½" point			
	2	Saw - Crosscut 26" 10 pt.			
	2	Saw - Back 14"			
	2	Saw - Coping 6 3/4"			
	1	Saw - Dovetail 10"			
	1	Saw - Compass 12"			
	12	Stops-Bench 1" x 2¼", 2" long			
	1	Screw-Mate Set			
	1	Wrench - Adjustable 12"			
	1	Wrench - Adjustable 10"			
	1	Wrench - Adjustable 8"			
	1	Wrench - Pipe 10" Aluminum			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
		WOOD TURNING TOOLS			
	3	Calpiers 6" outside			
	3	Calipers 6" inside			
	3	Dividers 6"			
	2	Sets Wood Turning Tools			
	8	Face Plate 6"			
	8	Face Plate 3"			
	2	Knockout Bar			
	2	Screw Center (Small Work)			
	1	Wood Turning Duplicator			
	2	Hand Wheel 5" Diameter			
	2	Rest, Tool 12" at 90°			

TOOL COST: Add up the cost of the tools and enter on Estimated Cost Blank.

EST. COST ________________

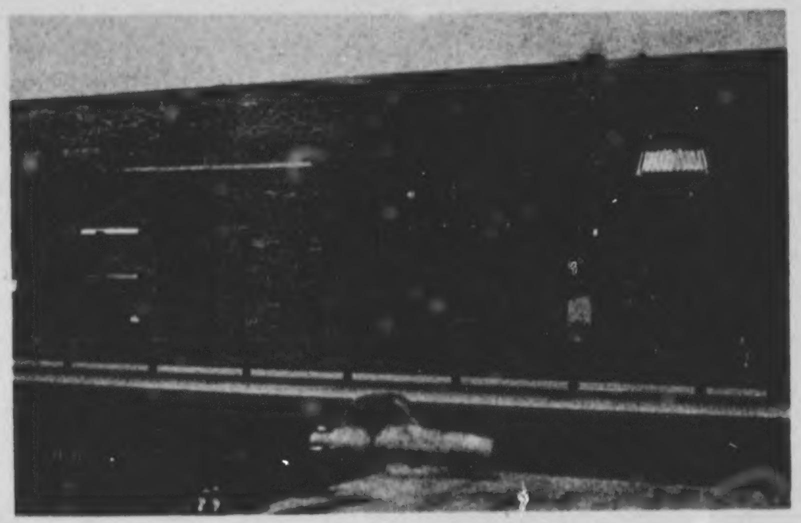
TIME: To order hand tools for Woods Area (3 hours).

EST. TIME ________________

WORKSHEET # 8.2

COLD METALS HAND TOOL LIST

PURPOSE: This suggested hand tool list will give you a good start on setting up a Metals Area. Xerox this list and use it as an order form and also check off the hand tools as they are delivered.



COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 3, 7, 13, 22, 24, 53, 55, 61, 62

BILL OF MATERIAL: Fill in the supplier and cost of each item.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Set Needle Files			
	2	File Cards 6"			
	2	File - Mill Smooth 10"			
	2	File - Mill 2nd Cut 10"			
	2	File - Mill Bastard 10"			
	2	File - Half Ro[illegible] Smooth 10"			
	2	File - Half Round 2nd Cut 10"			
	2	File - Round 2nd Cut 10"			
	12	File Handles #3			
	2	Awl - Scratch 6"			
	2	Brush - Wire 6"			
	1	Bevel - Sliding T 6"			
	2	Rule - Metal 12"			
	2	Rule - Metal 24"			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Square - Steel 24"			
	2	Square - Tri 6"			
	2	Square - Combination 12"			
	1	Set-Screwdriver 7 pc. including Phillips			
	4	Clamps - "C" 1¼"			
	4	Clamps - "C" 2"			
	8	Clamps - "C" 4"			
	2	Clamps - Vice Grip C Type 6"			
	2	Clamps - Welding Vise Grip			
	1	Wrench - Adjustable 8"			
	1	Wrench - Adjustable 10"			
	1	Wrench - Adjustable 12"			
	1	Wrench - Pipe 12" Aluminum			
	1	Vise - Pipe 2¼"			
	1	Tap and Die Set			
	1	Drill set - Twist 1/16" through 1/2" by 64th			
	2	Counter Sink			
	1	Knife - Putty			
	2	Saw - Hack 12"			
	1	Nippers - End cutting 8"			
	2	Pliers - Combination 6"			
	2	Pliers - Side Cutting 6"			
	2	Dividers - 6"			
	1	Tap and Drill Gauge			
	1	U. S. Standard Gauge			
	1	American Standard Wire Gauge			
	1	Center Gauge			
	1	Screw Pitch Gauge			
	1	Protractor			
	1	Set Center Punches			
	1	Set Drive Punches			
	4	Brush - Utility 8"			
	2	Hammer - Ball Pein 12 oz.			
	2	Hammer - Riveting 12 oz.			
	2	Hammer - Tinners Setting 12 oz.			
	2	Mallet - Plastic 10 oz.			
	2	Mallet - Rawhide 2"			
	1	Groover, Hand #0			
	1	Groover, Hand #2			
	1	Groover, Hand #4			
	1	Rivet Set #5			
	1	Rivet Set #6			
	1	Rivet Set #7			
	1	Metal Punch #5			
	2	Handy seamer			
	2	Snips - Tin 3" Cut			
	1	Snips - Circular 7"			
	1	Snips - Aviation (M1 WISS)			
	1	Snips - Aviation (M2 WISS)			

COLD METALS HAND TOOL LIST

TOOL COST: Add up cost column.

EST. COST ____________________

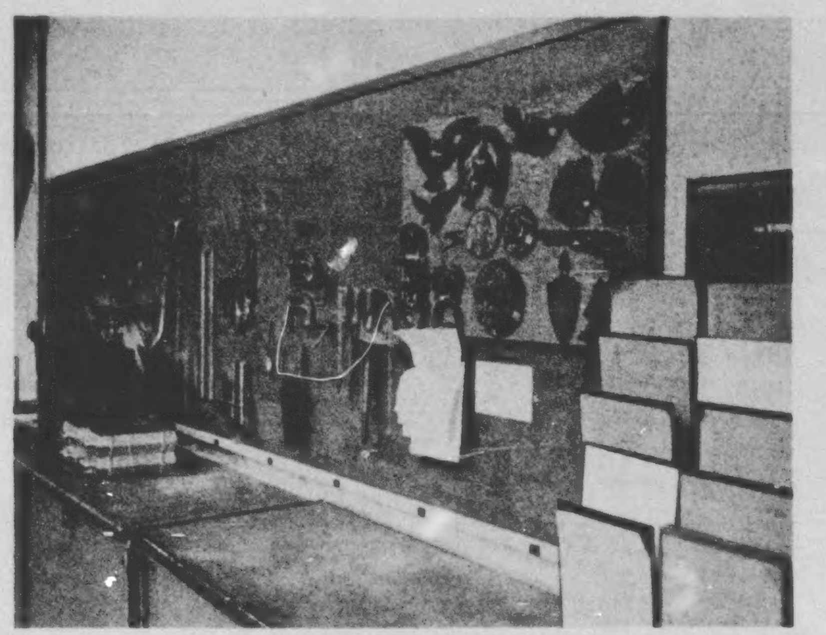
TIME: To check hand tools on hand and list tools to be ordered (2 hours).

EST. TIME ____________________

WORKSHEET # 8.3

HOT METALS TOOL LIST

PURPOSE: The following is a suggested basic Hot Metals tool list. You will need to read through the list and add certain things that you may need. Xerox the list and use it for inventory.



COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 7, 13, 22, 31, 61, 62, 65

BILL OF MATERIALS: Fill in the supplier and cost. If possible, order from a local vendor so you can replace hand tools if needed.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	2	Bench Rammer			
	1	Bellows - 10"			
	1	Foundry Riddle - 8" Mesh			
	1	Bulb Sponge 8 oz.			
	1	Shovel - square point			
	2	Brass Sprue Cutter			
	2	Spoon and Gate Cutter			
	4	Aluminum Foundry Flasks 8" x 10"			
	3	Molders Asbestos, Aprons, Leggings and Sleeves			
	1	Melting Ladle			
	3 pr.	Asbestos Gloves			
	1	#6 Ingot Mold			
	1	Anvil			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Anvil Stand			
	2	Blacksmith Handhammer 40 oz.			
	2	Pick up Tongs 24"			
	2	Flip Front Fiberglas Welding Helmets			
	4	Welding Vise Grips			
	4	Morsite Goggles			
	4	Sparklighters			
	2	Tip Cleaners			
	4	Pair Welders Gloves			
	2	Wire Brush			
	2	Chipping Hammers			
	2	Brush - Utility 8"			
	4	Face Shields 8" x 10"			
	1	Pair Soldering Coppers			
		Crucibles - #10 Graphite			

TOOL COST: Total up the cost column.

EST. COST ____________________

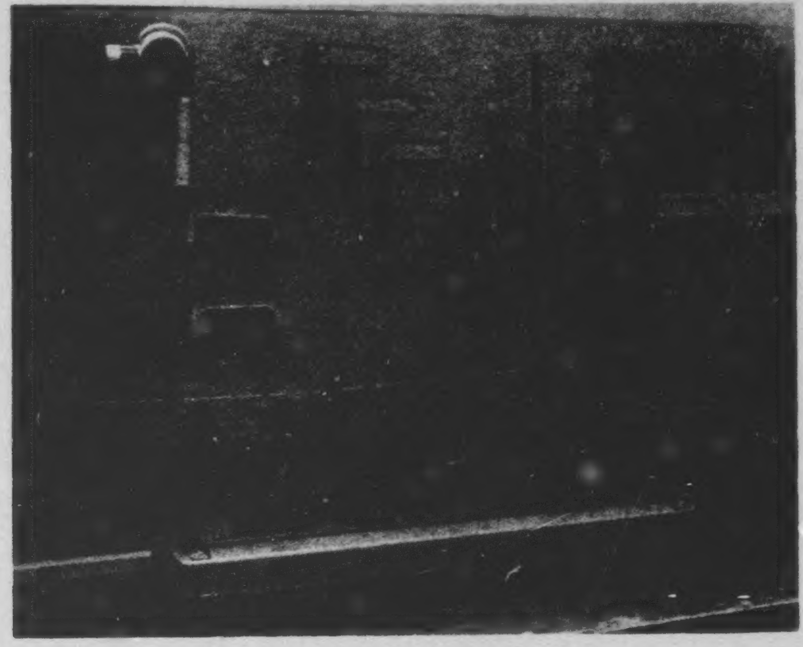
TIME: To order Hot Metals hand tools (2 hours).

EST. TIME ____________________

WORKSHEET # 8.4

PLASTICS HAND TOOL LIST

PURPOSE: Check the appropriate columns to see what items you have on hand and what items need ordering. This suggested Plastics Hand Tool List will give you a good start on developing a Plastics area.



COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 7, 15, 18, 28, 61

BILL OF MATERIALS: Fill in the name of the supplier and the item cost. If you order from a local vendor you may receive quicker and better service.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Screwdriver Set, 7 pcs. including Phillips			
	2	Pliers - Combination 6"			
	2	Brayer 4"			
	4	Spring Clamps			
	2	Triangle 30° - 60°			
	2	Triangle 45°			
	2	Awl - Scratch 6"			
	1	Bevel, Sliding T			
	2	Dividers - Swing 6"			
	2	File Flat 10"			
	2	File - Round 10"			
	2	File - Card 4"			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Hammer - Claw 1002, 13 oz.			
	2	Knives - Putty			
	1	Mallet - Rawhide 3" dia.			
	1	Pliers - Vise Grip 6" C Clamp			
	1	Punch - Revolving with replaceable punch tubes			
	2	Rule - Steel 24"			
	2	Rule - Steel 12"			
	1	Saw - Dovetail 10:			
	1	Saw - Back 12"			
	1	Saw - Coping			
	2	Scissors 6"			
	1	Snips, Tin, 12"			
	1	Square - Steel 24"			
	2	Square - Tri 6"			
	1	Wrench, Adjustable 10"			
	1	Wrench, Adjustable 8"			

TOOL COST:

EST. COST ______________

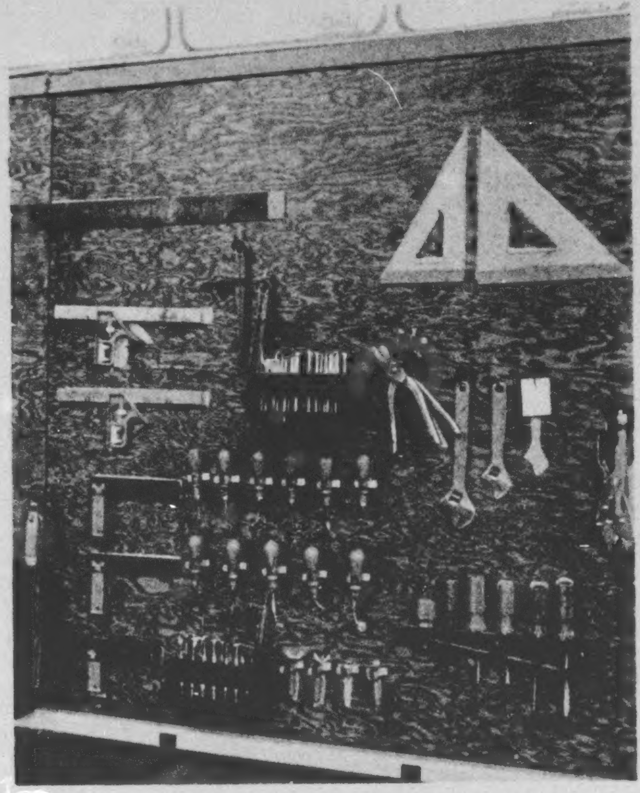
TIME: To make out plastic tool order (1 hour).

EST. TIME ______________

WORKSHEET # 8.5

CRAFTS HAND TOOL LIST

PURPOSE: The suggested Craft Tool List has the largest amount of tools of any hand tool list. Because of the size of this list, read through it carefully and check the correct columns. You may need to add to this list.



COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 2, 16, 58, 61, 62

BILL OF MATERIALS: After you have determined the items you will need to order, pencil in the supplier's name and item cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	4	Straight Gouges 1/4"			
	2	Straight Gouges 3/8"			
	3	V Parting Tools 1/4"			
	2	Brush - Utility 8"			
	4	Carving Knives 7" Long			
	1	Hard Arkansas Bench Stone			
	1	India Bench Stone Combination			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1 set	Hard Arkansas Slip Stones			
	1 set	India Carving Tool Slips			
	4	Hold Down Clamps			
		ART METAL			
	1	American Standard Wire Gauge			
	2	Awl - Scratch 6"			
	2	Dividers 6"			
	2	Rule, Steel 24"			
	2	Combination Snips 7"			
	2	Pocket Circular Snips 7"			
	2	Planishing Hammer			
	2	Anvil Base 4" High			
	2	Raising Hammer			
	2	Forming Hammer			
	2	Mallets, Wood			
	2	Mallets, Rawhide			
	1	Square Anvil Head			
	1	Tablespoon Anvil Head			
	1	Dome Anvil Head			
	1	Valley Anvil Head			
	1	Slope Anvil Head			
		COPPER ENAMELING			
	1	Set Swiss Needle Files			
	1	File Card			
	4	Tweezers			
	2	Fork, Enameling 16 1/2"			
	2	Spatula			
	2	Rack, Enameling Screen 3/4"			
	2	Shear, Jewelers			
	2	Saw, Jewelers Frame			
		LEATHER			
	2	Shears - All purpose			
	2	Knives - Utility, Adjustable			
	1	Draw Gauge			
	1	Snap - All Tool Set			
	2	Slicker, Circle Edge			
	2	Divider - Wing 6"			
	2	Brush, Utility 8"			
	4	Mallet - Rawhide 6 oz.			
	1	Stamps, Alphabet 1"			
	1	Stamps, Alphabet ½"			
	4	Rules, Wood 12"			
	2	Rules, Wood 24"			
	4	Swivel Cutters			
	1	Snap Setter			
	1	Rotary Punch			
	2	Bag Punch ½" & 1"			
	1	Spacer			
	1	Cement Container			

WORKSHEET # 8.5 (Continued)

CRAFTS HAND TOOL LIST

ON HAND	NO REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
		THONGING CHISELS			
	1	1/8" 1 slit			
	1	1/8" 3 slit			
	1	3/32" 1 slit			
	1	3/32" 3 slit			
	2	Lacing Fid			
	1	Lacing Pliers			
	1	Creaser, Size 1			
	1	Creaser, Size 5			
	1	Beveler, Size 2			
	1	Beveler, Size 4			
		MODELING TOOLS			
	2	Deer Foot			
	2	Modeler			
	2	Tracing			
		BEVELERS			
	2	B935			
	2	B200			
		CAMOUFLAGE			
	2	C428			
	2	C709			
		PEAR SHADERS			
	2	P972			
	2	P208			
		STAMPING TOOLS			
	1	J787			
	1	J786			
	1	S866			
	1	D617			
	1	F990			
	1	C431			
	1	L515			
	1	L516			
	1	W532			
	1	W531			
	1	Y659			
	1	Y658			
	1	Y659			
	1	Y648			
	1	S347			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
		STAMPING TOOLS (Cont)			
	1	W965			
	1	Y654			
	1	Y653			
	1	P368			
	1	V707			
	1	Z785			
		SEEDERS			
	2	S706			
		MULEFOOT			
	2	U858			
		VIENERS			
	2	V406			
		FLOWERS			
	2	W531			
		LEAVES			
	2	L953			
	2	L954			

TOOL COST:

EST. COST. ______________

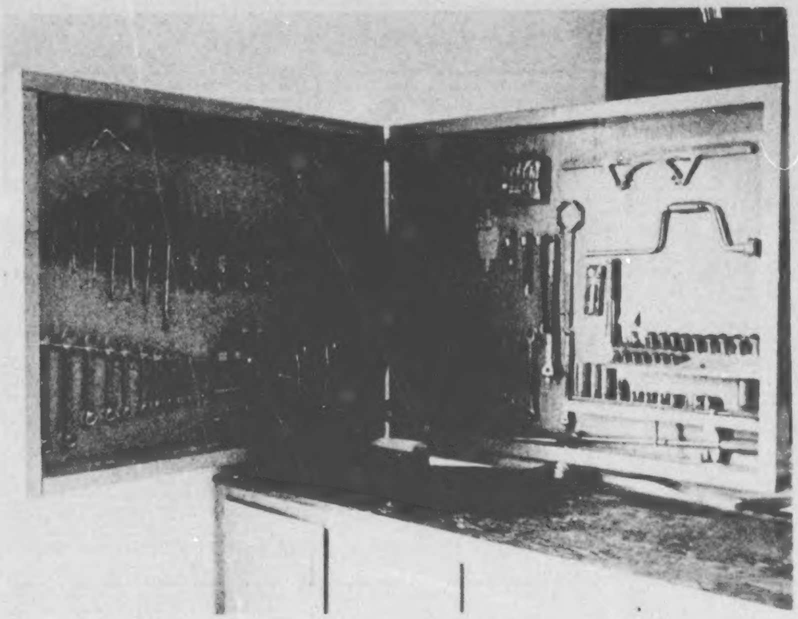
TIME: To order Craft tools (3 hours).

EST. TIME ______________

WORKSHEET # 8.6

POWER MECHANICS HAND TOOL LIST

PURPOSE: The following suggested Hand Tool List will aid you in setting up a Power Mechanics activity area. Check the appropriate columns to see what items need to be ordered and what you have on hand.



COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 7, 8, 13, 53, 61, 62

BILL OF MATERIAL: Pencil in the supplier's name and item cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Wrench - Torque In #0-200			
	1	Wrench - Torque Ft #0-50			
	1	Feeler Gauge Size .001-.035			
	1	Feeler Gauge Metric			
	1	Compression Gauge			
	1	File - 8" Three Square			
	1	File - 10" Half Round			
	1	File - 10" Flat			
	1	File Card			
	6	File Handles #3			
	1	Cylinder Hone - 3½"			
	1 set	Easy Outs			
	1	Hand valve grinder			
	1	Hand Seat Attachment-Grinder			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Ring Expander			
	1	Ring Compressor			
	1	Tap & Die - Metric			
	1	Valve Cup			
	1	Punch - Pin 8/32"			
	1	Mallet - Plastic 10 oz.			
	1	Mallet - Rubber			
	1	Mallet - Tinners. Wood 3" x 6"			
	1	Pliers - 7½" Locking Wrench			
	1	Nippers - 7" End Cutting			
	2	Clamp - C 4"			
	2	Oil Cans			
	1	Gas Can - 2 gal.			
	1	10 Gallon oily rag waste can			
	1	Flywheel Holder - Briggs			
	1	Flywheel Puller - Briggs			
	2	Brush - Utility 8"			
	2	Brush - Wire			
	1	Screwdriver Set 7 pcs. including Phillips			
	2	Putty Knives			
	1	Pliers - 7" Channel Lock			
	1	Pliers - 6" Needle nose			
	1	Pliers - 6" combination			
	2	Wrench set - Allen			
	1	Wrench set - open/box end combination 1/8" through 1¼"			
	1	Wrench - Adjustable 8"			
	1	Wrench - Adjustable 10"			
	1	Wrench - Clutch			
	1	Wrench set - Metric combination 10 pc 6 MM - 19 MM			
	1	Socket Set - Metric 3/8" Drive			
	1	Socket Set - 3/8" Drive ¼" through 1"			
	1	Nut Driver set 7 pcs.			
	1	Punch - Hand ¼"			
	1	Punch - Hand 1/8"			
	1	Punch - Pin 4/32"			

TOOL COST:

EST. COST ______________

TIME: To order tools (2 hours).

EST. TIME ______________

WORKSHEET # 8.7

GRAPHICS HAND TOOL LIST

PURPOSE: The following suggested hand tool list will aid you in setting up a Graphics area. Check the appropriate columns to see what tools need to be ordered.

COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 7, 19, 30, 61

BILL OF MATERIAL: Fill in the supplier and item cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Paper Cutter 24"			
	2	Shears - Trimming 7"			
	2	Rules - 24" Steel			
	2	Rules - 12" Steel			
	1	Rule - 48" Steel			
	1	Brayer - 2½"			
	1	Brayer - 3½"			
	2	Benzine Cans - Quart Size			

TOOL COST:

EST. COST ____________________

TIME: To make out tool order (½ hour).

EST. TIME____________________

WORKSHEET # 8.8

GENERAL INDUSTRIES HAND TOOL LIST

PURPOSE: Check the suggested hand tool list to see what you have on hand and what needs to be ordered. If your facility has a Woods area, you will not have to order many of the tools listed for General Industries. Check the Woods tool list carefully before ordering any General Industries items.

COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 7, 13, 47, 62

BILL OF MATERIAL: Fill in the supplier and cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	2	Trowel - Finishing 4" x 14" Aluminum			
	2	Floats - Rubber 4" x 9½"			
	2	Trowel, Cement 4½" x 10"			
	2	Trowel, Patching 1 3/4" x 5½"			
	2	Glass Cutters			
	1	Glass Cutter - Circle			
	2	Hammer - Bricklaying 16 oz. 7" long			
	2	Chisel - Bricklaying, 4" long 5/8" single bevel			
	2	Trowel - Painting 2 3/4" x 5½"			
	2	Trowel - Birck, 5" x 10½"			
	2	Rubbing Brick, 6" x 3"			
	2	Knife - Taping, 3½" x 11"			
	2	Corner Taping Tool			
	2	Mud Pan Stainless 14"			
	1	Chisel Set ¼ through 1¼"			
	1	Brace 8"			
	1	Bits - Auger Set #4 thru #16			
	1	Bit - Expansion #2			
	2	Saw - Rip 26"			
	2	Saw - Cross Cut 26"			
	1	Saw - Compass 12"			
	1	Saw - Hack 12"			
	2	Squares - Combination			
	1	Belve - T, 8" sliding			
	1	Steel tape - 50'			
	2	Squares - Framing 24"			
	1	Wrench - Adjustable 8"			
	1	Wrench - Adjustable 12"			
	1	Wrench - Pipe 10" aluminum			
	1	Set - Nail 1/32", 2/32", 3/32"			
	2	Hammers - Claw			
	1	Screwdriver Set 7 pcs.			
	2	Knife - Putty 6"			
	2	Knife - Utility 6" Adjustable			

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Plane - Black 6"			
	1	Plane - Jack 14"			
	2	Pliers - Combination 6"			
	1	Pliers - Side Cutter 7"			
	1	Level, Aluminum 24"			
	1	Chalk Line			
	1	Plumb Bob			
	2	Brush, Wire			
	1	Mallet, Rubber 20 oz.			
	1	Hose - 50' soft, w/nozzle			
	1	Hoe - two-hole 5½' handle 10" blade			
	1	Shovel, Round point			
	1	Shovel, Square			
	4	Saw Horse Bracket (Pair)			
	1	Rake - Steel			
	1	Wheelbarrow			
	1	Scraper - Wall 4"			
	2	Edger - Curved 3" x 6"			
	2	Float - Redwood 12" x 5"			
	2	Grover - 3" x 6"			

TOOL COST:

EST. COST ____________________

TIME: To order new tools (2 hours).

EST. TIME ____________________

WORKSHEET # 8.9

ELECTRICITY/ELECTRONICS HAND TOOL LIST

PURPOSE: This suggested hand tool list will give you a good start on setting up an Electricity/Electronics area. Read through the lists and check the appropriate columns.

COLOR CODIING: See Worksheet 10.3.

VENDOR I.D. #: 1, 7, 13, 61, 63

BILL OF MATERIAL: Fill in the supplier and cost of each item.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	2	Brush, Utility 8"			
	2	Awl, Scratch 6"			
	2	Pliers, Needle Nose			
	2	Pliers, Combination 6"			
	2	Pliers, Side cutting			
	2	Pliers, Standard Diagonal			
	1	Plier, Vise Grip 6"			
	2	Screwdriver, Rubber Grip 6"			
	1	Screwdriver Set, 7 pc. including Phillips			
	1	Nut Driver Set			
	2	Rules, Steel 12"			
	2	Punch, Center			
	1	Saw, Hack 12"			
	2	Square, Combination 12"			
	2	Clamps, Spring 2 3/4"			
	1	Rivetool Kit - Pop			
	1	#5 Metal Punch Set			
	2	Heat Sinks, heavy duty			
	2	Crimping tools			
	2	Wire Stripper			
	1	Low Voltage Tester			
	1	Ne-O-Lite Tester			
	1	File Card			
	2	Files, Half-Round Smooth 8"			
	2	Files, Half-Round 2nd Cut 8"			
	6	File Handles #2			

TOOL COST:

EST. COST ______________

TIME: To make out tool order (½ hour).

EST. TIME ______________

WORKSHEET # 8.10

DRAFTING HAND TOOL LIST

PURPOSE: Since most junior high schools have a drafting program, you may have all these suggested hand tools on hand. Check the columns to see what needs to be ordered.

COLOR CODING: See Worksheet 10.3.

VENDOR I.D. #: 7, 10, 19, 30, 59, 61

BILL OF MATERIAL: Write in the name of the supplier and item cost.

ON HAND	NO. REQ.	DESCRIPTION	TO ORDER	SUPPLIER	COST
	1	Drafting Machine, Standard			
	6	T Square, 24"			
	6	Triangles, 30^o - 60^o			
	6	Triangles, 45^o			
	6	Scales, Architect 12"			
	2	Scales, Engineer 12"			
	1	Pencil Sharpener, Draftsman			
	2	Protractors, 6" plastic			
	2	Lettering Triangles			
	2	Irregular Curves			
	6	Erasing Shields			
	1	Lettering Set			
	6	Drawing Sets, Big Bow			

TOOL COST:

EST. COST ______________

TIME: To check tools on hand and order new tools (½ hour).

EST. TIME ______________

WORKSHEET # 9

COLOR CODING

PURPOSE: Each area in the facility is color coded to help students find those tools they need, and to provide a system for their return to the proper place. Equipment is color coded to national standards as described in Worksheet 12.11. Books, loop films and other resources are also coded for ease of organization.

The activity areas of the shop can be identified by the color coded wood signs that hang from the ceiling and the color coded media boards (tool panels). The various self-contained areas are color coded, and the tools, tool silhouettes, cabinet fronts, instruction sheets, books, films and other various aids are coded by the color for each area.

The following is the color code for each area of the shop:

AREA	COLOR
Woods	Yellow
Cold Metals	Blue
Hot Metals	Red
Plastics	Pink
Crafts	Purple
Power Mechanics	Orange
Graphics & Drafting	Green
General Industries	Grey
Electricity/Electronics	White
Planning (Media)	Wood Grain (Stain)

COLOR CODING: Several methods of color coding have been used in the Career Exploration program. The best of the several methods is the following:

1. Purchase a colored roll of contact paper for each activity area in your program.
2. Take a sample piece of each color of contact paper to the local paint store. Have the paint dealer mix a quart of paint to match each different color of the contact paper.
3. Keep the mixing identification number of each quart of paint on hand so it will be easy to obtain more paint as needed.
4. Use either contact paper or paint (the same color), to color code your various activity areas.
5. Worksheets in this guide state the color to use to code each item listed.

VENDOR I.D. #: 14, 36, 38, 40

BILL OF MATERIAL: You will need to order a different colored paint for each activity area.

ACTIVITY AREA	COLOR	# QTS.	IDENT. #	COST

# Rolls of contact paper ________ @ ______________ COST ____________________

MATERIAL COST: Add up the paint and contact paper costs.

EST. COST ________________

TIME: To determine color, order contact paper and paint (1 hour)

EST. TIME ________________

WORKSHEET # 10

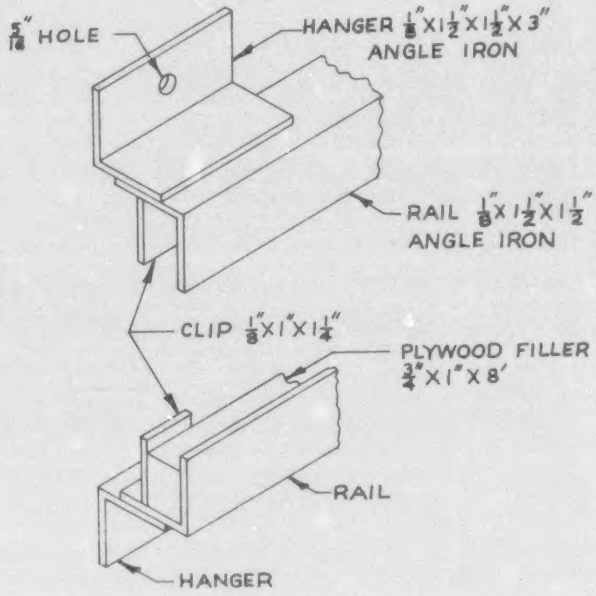
MEDIA BOARDS

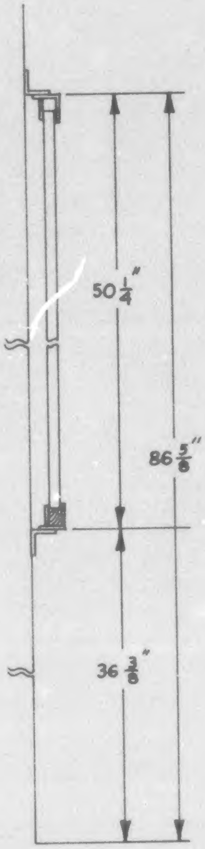
PURPOSE: Worksheet series 10 relates to the media boards, or tool panels, that are an important feature of your shop. Worksheet 10.1 describes construction of the holder for mounting the boards at eye level or above for easy viewing by students. Worksheet 10.2 relates to that portion of the boards on which tools are mounted. The rest of the worksheets in Series 10 refer to other items that are mounted on media boards.

WORKSHEET # 10.1

MEDIA BOARD (TOOL PANEL) HOLDER

PURPOSE: The media board holder is used to mount media boards (tool panels) in each of the areas of your shop. The media board can be slipped in and out of the holder with ease. This allows flexibility within the shop. Instructions for building the holder are on the next page.


5/16" HOLE
HANGER 1/8"X1 1/2"X1 1/2"X3" ANGLE IRON
RAIL 1/8"X1 1/2"X1 1/2" ANGLE IRON
CLIP 1/8"X1"X1 1/4"
PLYWOOD FILLER 3/4"X1"X8'
RAIL
HANGER


50 1/4"
86 5/8"
36 3/8"

COLOR CODING: Paint the front surface of the top and bottom rail the color of the activity area.

VENDOR I.D. #: 3, 41, 52

BILL OF MATERIAL: The following Bill of Materials is just figured for a twenty-foot wall section. You will have to figure out how many you will need for your particular shop.

# PCS.	NAME	T	W	L	MATERIAL
2	Top and Bottom Rails	1/8"	1 1/2"	20'	Angle Iron
8	Hangers	1/8"	1 1/2"	3"	Angle Iron

# PCS.	NAME	T	W	L	MATERIAL
12	Clips	1/8"	1"	1 1/4"	Flat Iron
3	Fillers	3/4"	1"	96"	Plywood

MATERIAL COST:

EST. COST________________

TIME: To cut, weld and construct media board holders (one 20' section, top and bottom, per hour).

Number 20' Sections_________ x _________hour = EST. TIME ________________

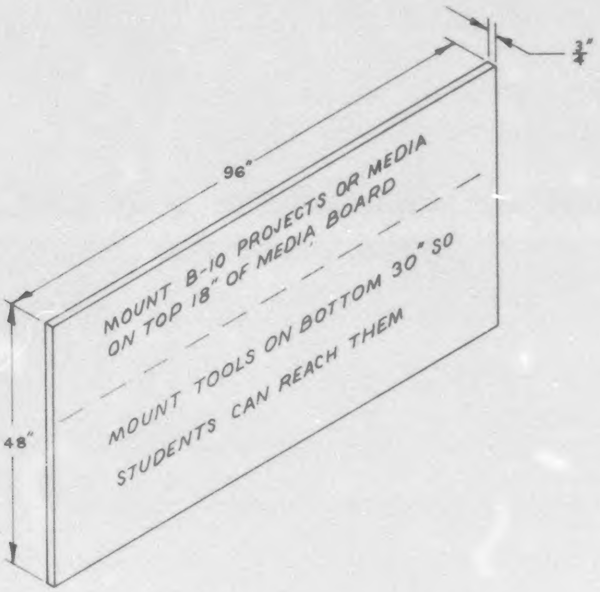
BUILDING THE ITEM: The critical part of constructing the holder is the positioning and mounting of the hangers. To use this method of construction requires a portable welder.

1. Strike a chalk line 36 3/8" and 86 5/8" from the floor on the wall. The reason for the 36 3/8" measurement is so a 36" high cabinet will slip under the rails.
2. Drill ¼" hole in center of each hanger.
3. Mark every 5' on bottom chalk line.
4. Mark every 10' on top chalk line.
5. On bottom line, place hangers to line (see sketch) and mark fastener location.
6. Repeat on top line, move hangers down to line.
7. Drill, place fasteners and bolt hangers to wall. If media board holder is to continue along the wall, the last hanger must be positioned to catch next 20' rail.
8. Lay top and bottom rail on floor.
9. Mark every 4' along both rails for clip position.
10. For correct space, place a narrow piece of plywood (3/4") between rail and clip.
11. Place clips next to plywood spacer and weld every 4' along rails.
12. With help, position the bottom rail on hangers and weld. Keep the rail the same distance from the wall at each weld.
13. Clamp the top rail under the hanger and weld. Remember the distance between rail and wall should be the same on the top and bottom. If they can't obtain a portable welder, you will have to pre-fab the holders at the maintenance shop or near your stationary welder. This is more difficult but this method will work.

WORKSHEET # 10.2

MEDIA BOARD (TOOL PANEL)

PURPOSE: Media Boards are used to hold tools, equipment, sample projects and media required by students to complete their shop activities. The lower half of the Board is reserved for mounting hand tools and electric portable tools. The upper half is reserved for the placement of Basic 10's, charts, illustrations, books, models and other varied media which reinforce the learning program. The Boards are mounted in holders around the perimeter of the facility (Worksheet 10.1). The Boards can be lifted out with a minimum of trouble and replaced with other boards to provide variety and flexibility in the shop.


3/4"
96"
48"
MOUNT B-10 PROJECTS OR MEDIA ON TOP 18" OF MEDIA BOARD
MOUNT TOOLS ON BOTTOM 30" SO STUDENTS CAN REACH THEM

COLOR CODING: No color coding is required if you code the Media Board holders (see Worksheet 10.1).

VENDOR I.D. #: 21, 37, 43, 47, 50

BILL OF MATERIALS:

3/4" x 48" x 96" Fir Plywood (sheets)

Hardware - sanding sealer or wood stain and roller

MATERIAL COST:

Number required ____________ @ Cost ______________ EST. COST _______________

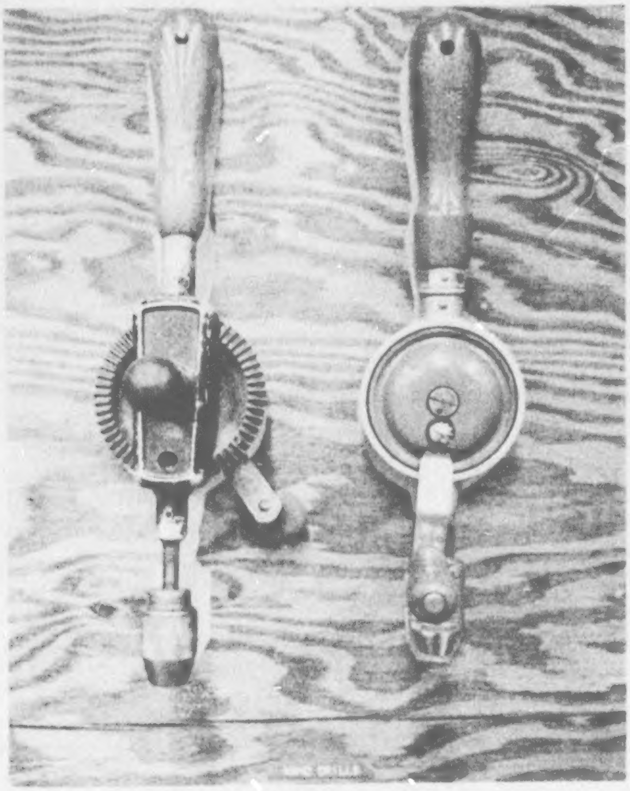
TIME: To cut and finish Media Boards (4 panels per hour).

Number required ________ ÷ __________ per hour = EST. TIME _______________

WORKSHEET # 10.3

HAND TOOL COLOR CODING

PURPOSE: So that students can easily locate, replace and care for tools, each tool is color coded. The best method has been painting of a part of each tool the color of the activity area where the tool is mounted.



COLOR CODING: See Worksheet 9.

VENDOR I.D. #: 36, 38

BILL OF MATERIAL: None

MATERIAL COST: None

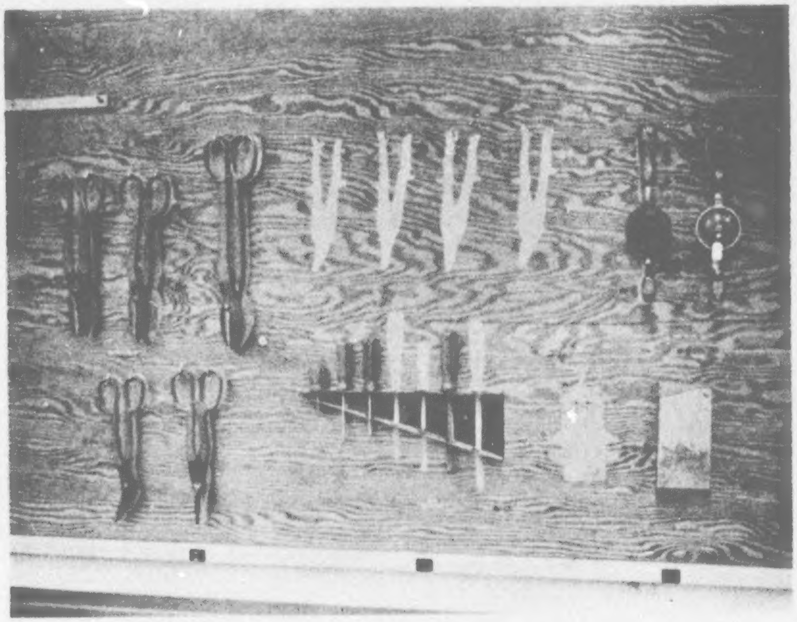
TIME: To mask and paint hand tools (10 tools per hour).

Number tools ________ ÷ ________ per hour = EST. TIME ______________

WORKSHEET # 10.4

HAND TOOL OUTLINE (SILHOUETTES)

PURPOSE: So that students can easily locate and care for tools, each tool is outlined on the media board with colored paint or colored contact paper. The quickest and best method has been the use of contact paper. Contact paper is easily removed and has the advantage of facilitating future changes in tool arrangement.



COLOR CODING: A different color of contact paper must be selected for each activity area in the shop.

VENDOR I.D. #: 14, 36, 38, 47

BILL OF MATERIAL: Suggest that you order a roll of contact paper for each activity area. (See Worksheet 9)

MATERIAL COST: None. See worksheet 9.

TIME: To outline and cut out silhouettes for all tools to be mounted on Media Boards (15 tools per hour).

Number tools ____________ ÷ ___________ per hour = EST. TIME ______________

WORKSHEET # 10.5

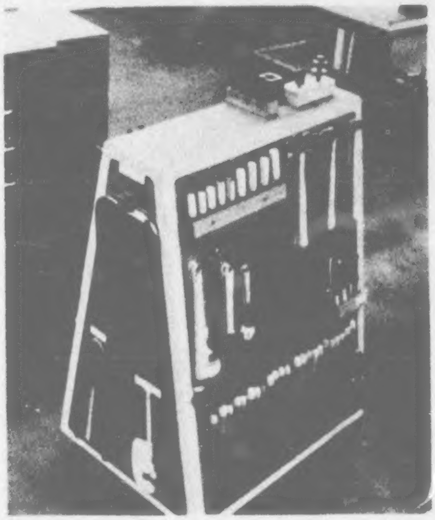
MOUNTING AND LAYOUT OF HAND TOOLS

PURPOSE: In the area considerations starting on page 24, we listed the average amount of media board (tool panel) space required to house the necessary hand tools for each area. Keeping the footage in mind, you should be ready to lay out and mount the hand tools in each area.

Following is a list of the tasks you should have completed before starting this step:

1. Media board (tool panel) holders mounted and in place (Worksheet 10.1).
2. Media Boards (tool panel) finished with wood stain or two coats of sanding sealer (Worksheet 10.2).
3. Hand tools color coded by activity areas (Worksheet 10.3).
4. Hand tool silhouettes cut out of colored contact paper (Worksheet 10.4).

If the four steps are completed, you are ready to lay out and mount your hand tools on the media boards. The most satisfactory method of laying out and mounting hand tools is to lay the media boards flat on workbenches, and position the hand tools on the boards as desired. Remember that the top 18" of the board is reserved for reference material, not hand tools. Once the tools are positioned, design and construct the tool holders. Keep in mind that the same tool may be used in other activity areas, so construct two or more identical tool holders at the same time. This will save planning time, material and construction time.



COLOR CODING: Paint your tool holders the activity area color.

VENDOR I.D. #: 36, 37, 38

BILL OF MATERIAL: We have used 1" and 2" pine, angle iron, sheetmetal and other materials for constructing tool holders. Fasten the tool holders to the media boards in such a way so they can be removed and relocated in the future.

MATERIAL COST: To figure the cost of material for tool holders, just put down an educated guess for material cost.

EST. COST ____________________

TIME: To build, color code and mount tool holders (4 holders per hour).

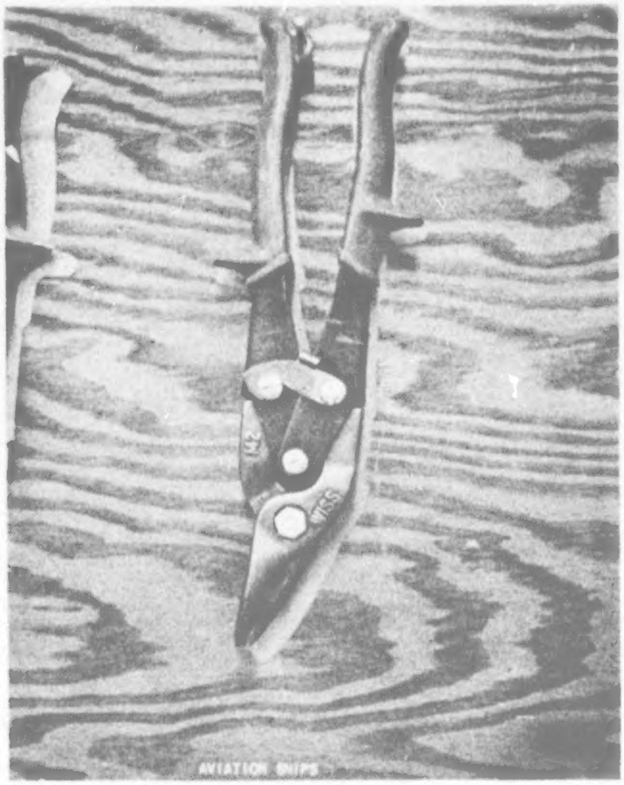
Number holders ______________ ÷ ________ per hour = EST. TIME ____________________

WORKSHEET # 10.6

HAND TOOL IDENTIFICATION

PURPOSE: Each tool in the shop is marked with its proper name. This is how students learn the vocabulary of the tools they use. This method of "incidental" learning has been found to be very effective.

One method of tool identification has been to use a labeling machine. The names of the tools are placed on the media boards (tool panels) just above or below the tool holders. Another method of labeling is using a plastic engraving machine. The plastic tags are nailed or glued to the media boards.



COLOR CODING: Two methods of color coding have been used. One is to buy a single color of labeling tape and use it for every tool mounted on the media boards (tool panels). The other method is to use labeling tapes of different colors, one color for each area of the shop.

VENDOR I.D. #: 7, 13, 36, 40

BILL OF MATERIAL: You will have to choose a method of color coding and then determine the amount of material needed.

MATERIAL COST:

ROLLS ____________ @ COST ______________________ EST. COST ________________

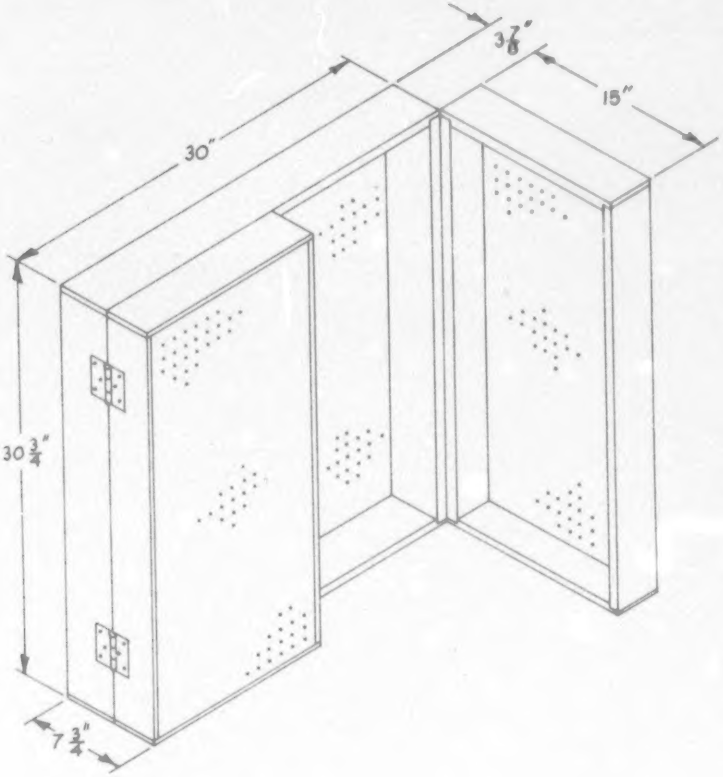
TIME: To make labels and mount on media boards (15 tools per hour).

Number of tools __________ ÷ 190 per hour = EST. TIME ________________

WORKSHEET # 10.7

SMALL TOOL CABINET

PURPOSE: This cabinet can be used to store small items or valuable tools that you wish to lock up at the end of the day. It can be used in a crafts, power mechanic or electronics area.



COLOR CODING: We suggest that you paint the box the color of the area in which it will be used.

VENDOR I.D. #: 36, 37

BILL OF MATERIALS

# PCS.	NAME	T	W	L	MATERIAL
8	Sides	3/4"	3 7/8"	30"	Fir
4	Top and Bottom	3/4"	3 7/8"	15"	Fir
2	Fronts	1/4"	14 1/4"	30"	Peg Board
1	Back	1/4"	29 1/4"	30"	Peg Board
4	Hinges				
1	Hasp & Padlock				

MATERIAL COST:

Number tool cabinets____________ @ Cost__________ EST. COST __________________

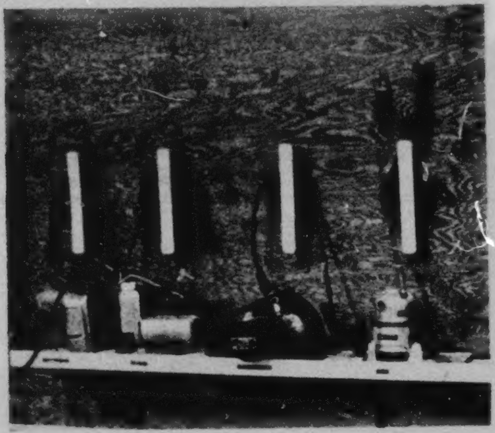
TIME: To construct and color code cabinet (2 hours per cabinet).

Number tool cabinets __________ X _________ hour = EST. TIME __________________

WORKSHEET # 10.8

PORTABLE TOOL HOLDER

PURPOSE: "A place for everything and everything in its place" is the motto we try to follow in the Career Exploration program. This applies to tools, materials, equipment and portable power tools. Portable tool holders openly displayed in activity areas where the tools are to be used is the method suggested. Label the holders with the name of the tool so that students can easily locate it.



COLOR CODING: Paint the holder the activity area color where it is to be mounted.

VENDOR I.D. #: 36, 37

BILL OF MATERIAL: To determine the size of the holder, you will need to identify the number of portable tools you wish to locate in each area.

MATERIAL COST: Design your tool holder and figure material cost.

EST. COST ________________

TIME: To build and color code (2 hours per holder).

Number holders__________ ÷ ________________ hour = EST. TIME ________________

WORKSHEET # 11

STUDENT MANAGEMENT SYSTEM

PURPOSE: The student management system is designed specifically to help learners manage their affairs in a self-instructional, student-directed program. The management system also serves the guidance needs of the staff by giving them current information on each student's activities and performance.

The student management system is essentially a notebook that is provided each student for his or her use in recording his activities in the shop. Worksheet 11.1 can be used for figuring the number of notebooks needed, in arranging for their purchase, and in color coding them before they are put to use. Worksheets 11.2 through 11.9 identify each of the notebook inserts that can help you plan for their duplication. You will also need a rack to store the notebooks. Specifications for such a rack are presented in Worksheet 11.10. "Plug-in boxes" are also needed at each activity area. Students put their notebooks in "plug-in boxes" so they can be close by, but still out of the way, while they are working on their projects. Worksheet 11.11 provides specifications for building a "plug-in box".

WORKSHEET # 11.1

STUDENT NOTEBOOKS

PURPOSE: Each student is issued a numbered, colored notebook. The number on the notebook designates the student and the color designates the period. The notebooks are housed in a rack right inside the shop door. When the students enter the shop, they draw their notebook and take it to the area in which they are working.

COLOR CODING: Each period has its own colored notebook. If you have six periods per day with the students, six different colored notebooks will be required.

VENDOR I.D. #: 29, 40

BILL OF MATERIAL:

PERIOD NO.	COLOR	NO. REQUIRED

MATERIAL COST:

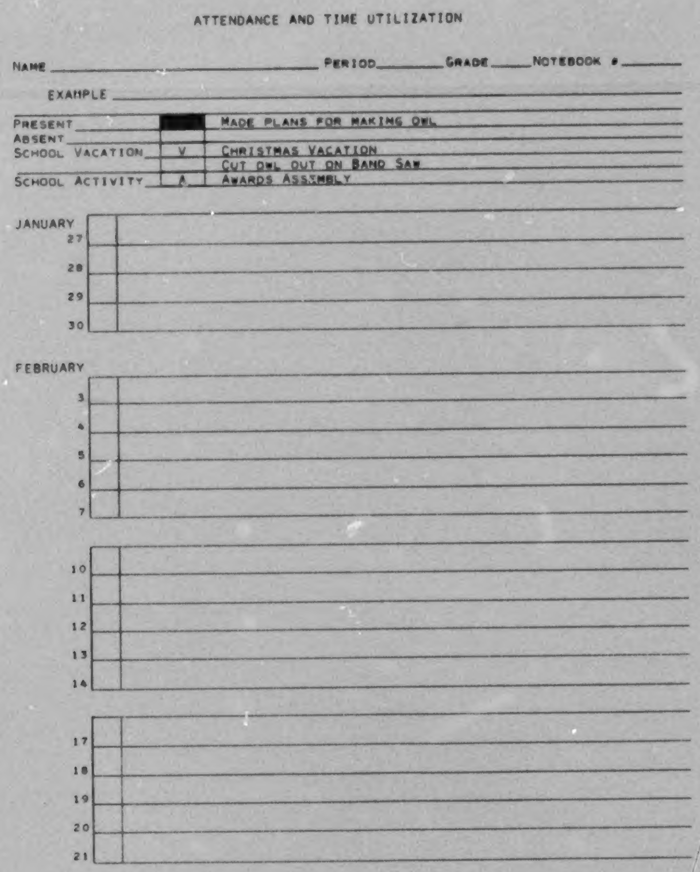
Number of colored notebooks __________ @ Cost __ = EST. COST ________________

TIME: To order and number notebooks (50 notebooks per hour).

Number of notebooks _______ ÷ _____195 per hour = EST. TIME ________________

ATTENDANCE & TIME UTILIZATION RECORD

PURPOSE: When the student enters the shop, he picks his notebook out of the notebook rack. The notebook is numbered and color-coded to the period in which he is enrolled. At the beginning of each period, the student marks in his attendance form opposite the date. After darkening in the rectangle opposite the date, the student begins work. This form will also be the last form of the period the student will make an entry in. Since we expect students to be accountable for their time spent in shop, we expect them to briefly note on the form how they spent their time in shop.



ATTENDANCE AND TIME UTILIZATION

NAME ______________________ PERIOD ________ GRADE ____ NOTEBOOK # ______

EXAMPLE ______________________

PRESENT	■	MADE PLANS FOR MAKING OWL
ABSENT		
SCHOOL VACATION	V	CHRISTMAS VACATION
		CUT OWL OUT ON BAND SAW
SCHOOL ACTIVITY	A	AWARDS ASSEMBLY

JANUARY

27		
28		
29		
30		

FEBRUARY

3		
4		
5		
6		
7		

10		
11		
12		
13		
14		

17		
18		
19		
20		
21		

COLOR CODING: Each attendance form is used for only nine weeks. We suggest you use four different colors of paper, one color for each quarter.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL:

Number of students ________X 4 = Number of Sheets ________________

PAPER COST:

Number of sheets ______________ of 20 pound colored paper

EST. COST ______________

TIME: To order paper, type and print form (500 sheets per hour).

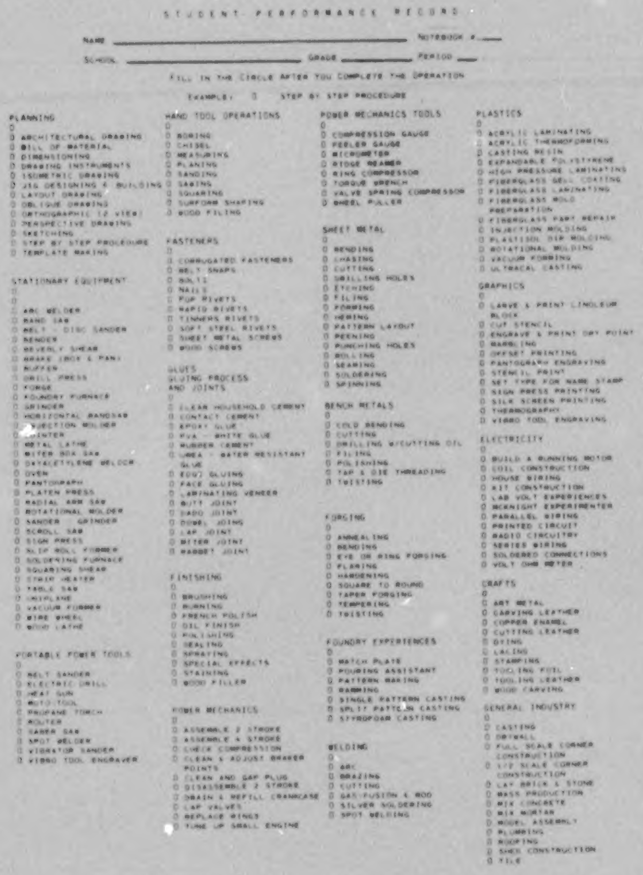
Number of sheets ______ ÷ ____________ per hour = EST. TIME ______________

WORKSHEET # 11.3

STUDENT PERFORMANCE RECORD

PURPOSE: The performance record is a listing of major areas in the shop, and it is a summary of all the potential activities offered in the facility. It serves as a quantitative assessment of what the student does rather than how well he accomplishes it. The qualitative evaluation takes place at the completion of each major activity.

The performance record is the student's way of recording his accomplishments in the shop. It can also be used as a report to the parents.



STUDENT PERFORMANCE RECORD

NAME ________________________ NOTEBOOK # ____

SCHOOL ________________ GRADE __________ PERIOD ____

FILL IN THE CIRCLE AFTER YOU COMPLETE THE OPERATION

EXAMPLE: ○ STEP BY STEP PROCEDURE

PLANNING
○
○ ARCHITECTURAL DRAWING
○ BILL OF MATERIAL
○ DIMENSIONING
○ DRAWING INSTRUMENTS
○ ISOMETRIC DRAWING
○ JIG DESIGNING & BUILDING
○ LAYOUT DRAWING
○ OBLIQUE DRAWING
○ ORTHOGRAPHIC (2 VIEW)
○ PERSPECTIVE DRAWING
○ SKETCHING
○ STEP BY STEP PROCEDURE
○ TEMPLATE MAKING

STATIONARY EQUIPMENT
○
○
○ ARC WELDER
○ BAND SAW
○ BELT - DISC SANDER
○ BENDER
○ BEVERLY SHEAR
○ BRAKE (BOX & PAN)
○ BUFFER
○ DRILL PRESS
○ FORGE
○ FOUNDRY FURNACE
○ GRINDER
○ HORIZONTAL BANDSAW
○ INJECTION MOLDER
○ JOINTER
○ METAL LATHE
○ MITER BOX SAW
○ OXYACETYLENE WELDER
○ OVEN
○ PANTOGRAPH
○ PLATEN PRESS
○ RADIAL ARM SAW
○ ROTATIONAL MOLDER
○ SANDER - GRINDER
○ SCROLL SAW
○ SIGN PRESS
○ SLIP ROLL FORMER
○ SOLDERING FURNACE
○ SQUARING SHEAR
○ STRIP HEATER
○ TABLE SAW
○ UNIPLANE
○ VACUUM FORMER
○ WIRE WHEEL
○ WOOD LATHE

PORTABLE POWER TOOLS
○
○ BELT SANDER
○ ELECTRIC DRILL
○ HEAT GUN
○ MOTO-TOOL
○ PROPANE TORCH
○ ROUTER
○ SABER SAW
○ SPOT WELDER
○ VIBRATOR SANDER
○ VIBRO TOOL ENGRAVER

HAND TOOL OPERATIONS
○
○ BORING
○ CHISEL
○ MEASURING
○ PLANING
○ SANDING
○ SAWING
○ SQUARING
○ SURFORM SHAPING
○ WOOD FILING

FASTENERS
○
○ CORRUGATED FASTENERS
○ BELT SNAPS
○ BOLTS
○ NAILS
○ POP RIVETS
○ RAPID RIVETS
○ TINNERS RIVETS
○ SOFT STEEL RIVETS
○ SHEET METAL SCREWS
○ WOOD SCREWS

GLUES
GLUING PROCESS
AND JOINTS
○
○ CLEAR HOUSEHOLD CEMENT
○ CONTACT CEMENT
○ EPOXY GLUE
○ PVA - WHITE GLUE
○ RUBBER CEMENT
○ UREA - WATER RESISTANT GLUE
○ EDGE GLUING
○ FACE GLUING
○ LAMINATING VENEER
○ BUTT JOINT
○ DADO JOINT
○ DOWEL JOINT
○ LAP JOINT
○ MITER JOINT
○ RABBET JOINT

FINISHING
○
○ BRUSHING
○ BURNING
○ FRENCH POLISH
○ OIL FINISH
○ POLISHING
○ SEALING
○ SPRAYING
○ SPECIAL EFFECTS
○ STAINING
○ WOOD FILLER

POWER MECHANICS
○
○ ASSEMBLE 2 STROKE
○ ASSEMBLE 4 STROKE
○ CHECK COMPRESSION
○ CLEAN & ADJUST BREAKER POINTS
○ CLEAN AND GAP PLUG
○ DISASSEMBLE 2 STROKE
○ DRAIN & REFILL CRANKCASE
○ LAP VALVES
○ REPLACE RINGS
○ TUNE UP SMALL ENGINE

POWER MECHANICS TOOLS
○
○ COMPRESSION GAUGE
○ FEELER GAUGE
○ MICROMETER
○ RIDGE REAMER
○ RING COMPRESSOR
○ TORQUE WRENCH
○ VALVE SPRING COMPRESSOR
○ WHEEL PULLER

SHEET METAL
○
○ BENDING
○ CHASING
○ CUTTING
○ DRILLING HOLES
○ ETCHING
○ FILING
○ FORMING
○ HEMING
○ PATTERN LAYOUT
○ PEENING
○ PUNCHING HOLES
○ ROLLING
○ SEAMING
○ SOLDERING
○ SPINNING

BENCH METALS
○
○ COLD BENDING
○ CUTTING
○ DRILLING W/CUTTING OIL
○ FILING
○ POLISHING
○ TAP & DIE THREADING
○ TWISTING

FORGING
○
○ ANNEALING
○ BENDING
○ EYE OR RING FORGING
○ FLARING
○ HARDENING
○ SQUARE TO ROUND
○ TAPER FORGING
○ TEMPERING
○ TWISTING

FOUNDRY EXPERIENCES
○
○ MATCH PLATE
○ POURING ASSISTANT
○ PATTERN MAKING
○ RAMMING
○ SINGLE PATTERN CASTING
○ SPLIT PATTERN CASTING
○ STYROFOAM CASTING

WELDING
○
○ ARC
○ BRAZING
○ CUTTING
○ GAS-FUSION & ROD
○ SILVER SOLDERING
○ SPOT WELDING

PLASTICS
○
○ ACRYLIC LAMINATING
○ ACRYLIC THERMOFORMING
○ CASTING RESIN
○ EXPANDABLE POLYSTYRENE
○ HIGH PRESSURE LAMINATING
○ FIBERGLASS GELL COATING
○ FIBERGLASS LAMINATING
○ FIBERGLASS MOLD PREPARATION
○ FIBERGLASS PART REPAIR
○ INJECTION MOLDING
○ PLASTISOL DIP MOLDING
○ ROTATIONAL MOLDING
○ VACUUM FORMING
○ ULTRACAL CASTING

GRAPHICS
○
○ CARVE & PRINT LINOLEUM BLOCK
○ CUT STENCIL
○ ENGRAVE & PRINT DRY POINT
○ MARBLING
○ OFFSET PRINTING
○ PANTOGRAPH ENGRAVING
○ STENCIL PRINT
○ SET TYPE FOR NAME STAMP
○ SIGN PRESS PRINTING
○ SILK SCREEN PRINTING
○ THERMOGRAPHY
○ VIBRO TOOL ENGRAVING

ELECTRICITY
○
○ BUILD A RUNNING MOTOR
○ COIL CONSTRUCTION
○ HOUSE WIRING
○ KIT CONSTRUCTION
○ LAB VOLT EXPERIENCES
○ MCKNIGHT EXPERIMENTER
○ PARALLEL WIRING
○ PRINTED CIRCUIT
○ RADIO CIRCUITRY
○ SERIES WIRING
○ SOLDERED CONNECTIONS
○ VOLT OHM METER

CRAFTS
○
○ ART METAL
○ CARVING LEATHER
○ COPPER ENAMEL
○ CUTTING LEATHER
○ DYING
○ LACING
○ STAMPING
○ TOOLING FOIL
○ TOOLING LEATHER
○ WOOD CARVING

GENERAL INDUSTRY
○
○ CASTING
○ DRYWALL
○ FULL SCALE CORNER CONSTRUCTION
○ 1/2 SCALE CORNER CONSTRUCTION
○ LAY BRICK & STONE
○ MASS PRODUCTION
○ MIX CONCRETE
○ MIX MORTAR
○ MODEL ASSEMBLY
○ PLUMBING
○ ROOFING
○ SHED CONSTRUCTION
○ TILE

COLOR CODING: The student performance record is printed on white paper. This form may have to be printed by a commercial printer if you have a large number of major areas in your shop.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL: Since this form is sent to the parents at the end of the quarter, you need to print five for each student. Keep a master copy.

Number of students___________ X 5 = Number of sheets _______________________

PAPER COST:

Number of sheets_________ of 24 pound white paper.

EST. COST______________

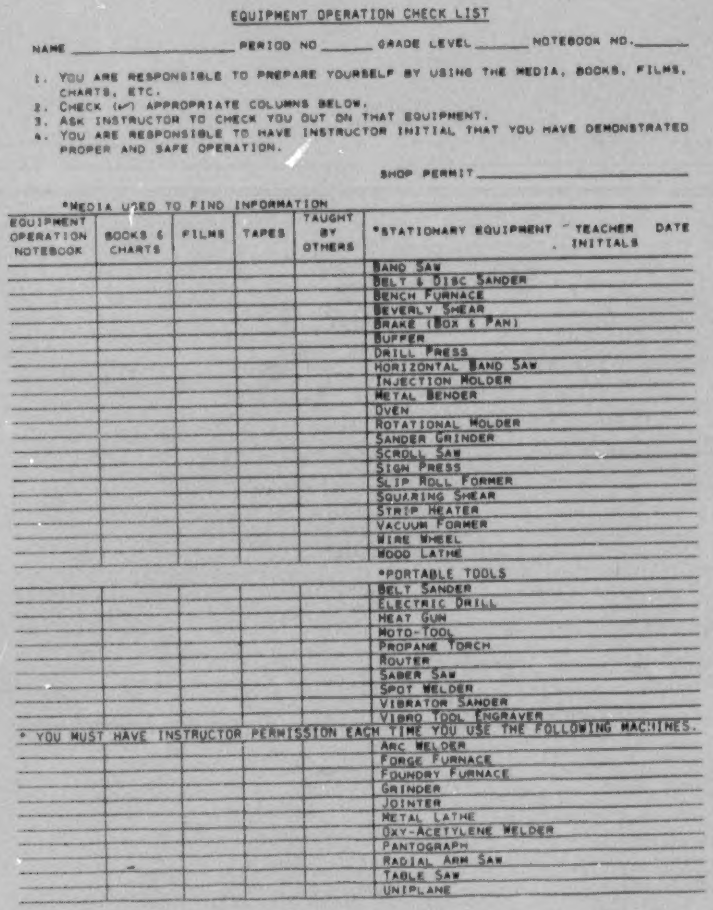
TIME: To order paper, type and print form (500 per hour).

Number of sheets_______ ÷ ____________ per hour = EST. TIME ______________

WORKSHEET # 11.4

EQUIPMENT OPERATION CHECK LIST

PURPOSE: Before students can use power equipment, they must prepare themselves by referring to the equipment operation notebooks and check lists. When he feels he knows the safety aspects, operating procedures and other techniques, the student then asks the teacher to check him out on the equipment. Due to the complexity of many pieces of equipment, the staff does not automatically initial the student's equipment operation check list until the student has been checked out.



EQUIPMENT OPERATION CHECK LIST

NAME ____________ PERIOD NO ______ GRADE LEVEL ______ NOTEBOOK NO. ______

1. YOU ARE RESPONSIBLE TO PREPARE YOURSELF BY USING THE MEDIA, BOOKS, FILMS, CHARTS, ETC.
2. CHECK (✓) APPROPRIATE COLUMNS BELOW.
3. ASK INSTRUCTOR TO CHECK YOU OUT ON THAT EQUIPMENT.
4. YOU ARE RESPONSIBLE TO HAVE INSTRUCTOR INITIAL THAT YOU HAVE DEMONSTRATED PROPER AND SAFE OPERATION.

SHOP PERMIT ____________

*MEDIA USED TO FIND INFORMATION							
EQUIPMENT OPERATION NOTEBOOK	BOOKS & CHARTS	FILMS	TAPES	TAUGHT BY OTHERS	*STATIONARY EQUIPMENT	TEACHER INITIALS	DATE
					BAND SAW		
					BELT & DISC SANDER		
					BENCH FURNACE		
					BEVERLY SHEAR		
					BRAKE (BOX & PAN)		
					BUFFER		
					DRILL PRESS		
					HORIZONTAL BAND SAW		
					INJECTION MOLDER		
					METAL BENDER		
					OVEN		
					ROTATIONAL MOLDER		
					SANDER GRINDER		
					SCROLL SAW		
					SIGN PRESS		
					SLIP ROLL FORMER		
					SQUARING SHEAR		
					STRIP HEATER		
					VACUUM FORMER		
					WIRE WHEEL		
					WOOD LATHE		
					*PORTABLE TOOLS		
					BELT SANDER		
					ELECTRIC DRILL		
					HEAT GUN		
					MOTO-TOOL		
					PROPANE TORCH		
					ROUTER		
					SABER SAW		
					SPOT WELDER		
					VIBRATOR SANDER		
					VIBRO TOOL ENGRAVER		
* YOU MUST HAVE INSTRUCTOR PERMISSION EACH TIME YOU USE THE FOLLOWING MACHINES.							
					ARC WELDER		
					FORGE FURNACE		
					FOUNDRY FURNACE		
					GRINDER		
					JOINTER		
					METAL LATHE		
					OXY-ACETYLENE WELDER		
					PANTOGRAPH		
					RADIAL ARM SAW		
					TABLE SAW		
					UNIPLANE		

COLOR CODING: The equipment operation check list is printed on green paper.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL:

Number of Students ________ X 1 = Number of Sheets ____________

PAPER COST:

Number of sheets ________ of 24 pound green paper ____________
EST. COST

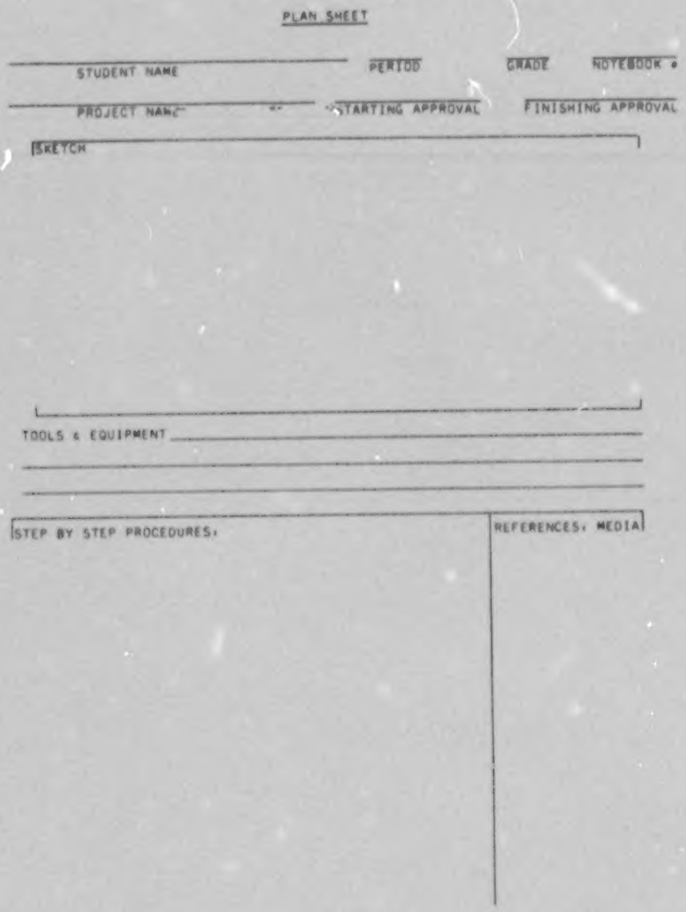
TIME: To order paper, type and print form (250 per hour)

Number of sheets ________ ÷ 200 per hour = EST. TIME ____________

WORKSHEET # 11.5

PLAN SHEET

PURPOSE: The plan sheet used by students is designed to be the instrument of communication between teacher and student. Mechanical drawing is not emphasized at this level, but drawing and sketching plays an important part. By capitalizing on the student's elementary art background, the staff reinforces sketching on plan sheets as communication skills.



PLAN SHEET

STUDENT NAME
PERIOD
GRADE
NOTEBOOK #
PROJECT NAME
STARTING APPROVAL
FINISHING APPROVAL
SKETCH
TOOLS & EQUIPMENT
STEP BY STEP PROCEDURES:
REFERENCES: MEDIA

COLOR CODING: The plan sheets are printed on white paper.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL: The number of plan sheets will be determined by the number of projects that students construct. Be prepared to print plan sheets as you need them.

Number of students__________ X 10 will give you a good starting supply.

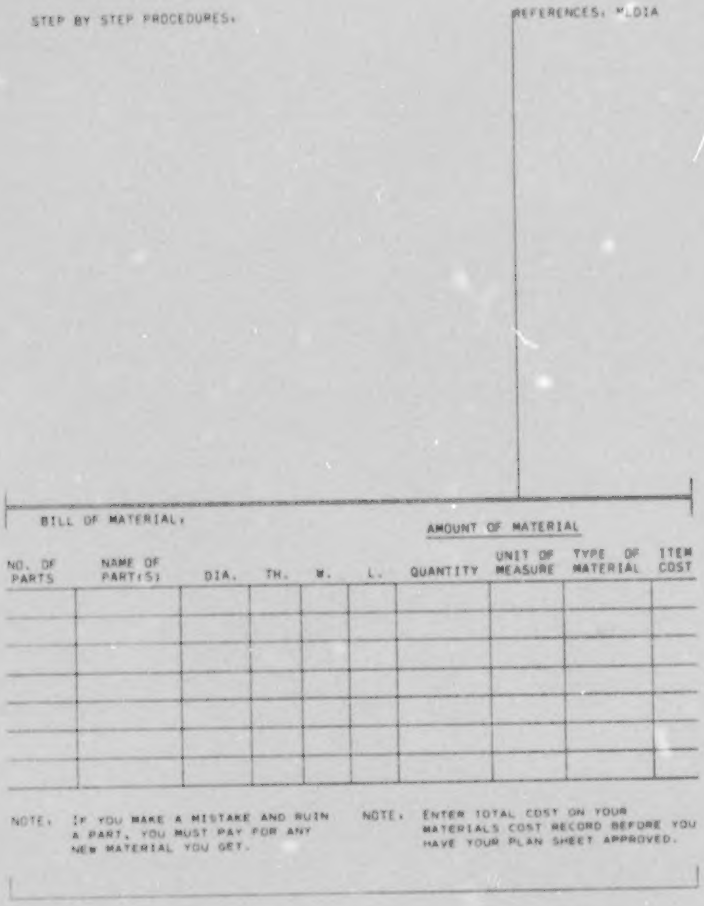
Number of Sheets ______________

PAPER COST:

Number of sheets ________of 24 pound white paper. EST. COST______________

TIME: To order, type and print plan sheets (500 per hour).

Number of sheets ______ ÷ _______per hour = EST. TIME ______________



STEP BY STEP PROCEDURES:

REFERENCES: MEDIA

BILL OF MATERIAL:

		AMOUNT OF MATERIAL							
NO. OF PARTS	NAME OF PART(S)	DIA.	TH.	W.	L.	QUANTITY	UNIT OF MEASURE	TYPE OF MATERIAL	ITEM COST

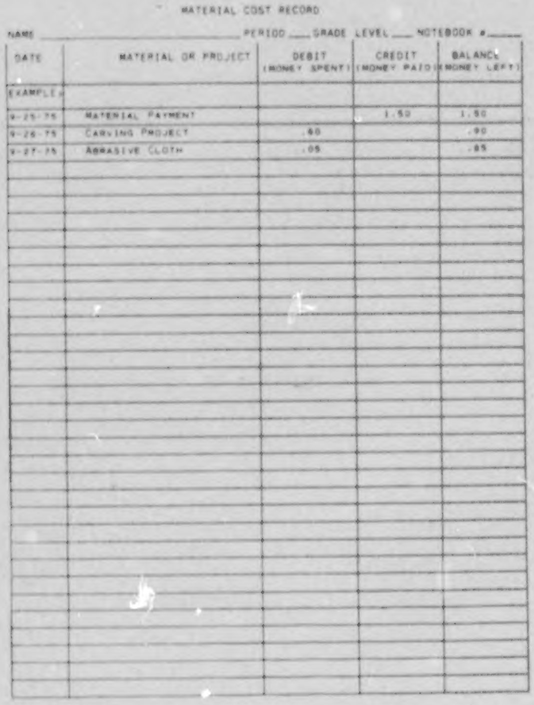
NOTE: IF YOU MAKE A MISTAKE AND RUIN A PART, YOU MUST PAY FOR ANY NEW MATERIAL YOU GET.

NOTE: ENTER TOTAL COST ON YOUR MATERIALS COST RECORD BEFORE YOU HAVE YOUR PLAN SHEET APPROVED.

WORKSHEET # 11.6

MATERIAL COST RECORD

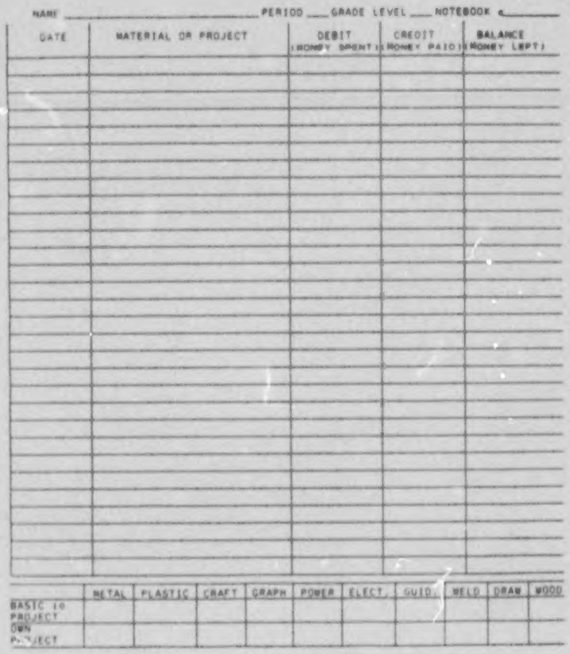
PURPOSE: A material cost record is important for several reasons. The student should learn the importance of conservation of material. He should know how much materials cost. When a student lists his costs, the instructor has a quick check on what a student is doing. Most importantly, the material cost record teaches the student to be responsible for his own purchases. Through the use of a material cost record, a student uses simple bookkeeping methods to keep records of his purchases.



MATERIAL COST RECORD

NAME ______________ PERIOD ___ GRADE LEVEL ___ NOTEBOOK # _____

DATE	MATERIAL OR PROJECT	DEBIT (MONEY SPENT)	CREDIT (MONEY PAID)	BALANCE (MONEY LEFT)
EXAMPLE:				
9-25-75	MATERIAL PAYMENT		1.50	1.50
9-26-75	CARVING PROJECT	.60		.90
9-27-75	ABRASIVE CLOTH	.05		.85



NAME ______________ PERIOD ___ GRADE LEVEL ___ NOTEBOOK # _____

DATE	MATERIAL OR PROJECT	DEBIT (MONEY SPENT)	CREDIT (MONEY PAID)	BALANCE (MONEY LEFT)

	METAL	PLASTIC	CRAFT	GRAPH	POWER	ELECT.	GUID.	WELD	DRAW	WOOD
BASIC 10 PROJECT										
OWN PROJECT										

COLOR CODING: The material cost record is printed on blue paper.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL:

Number of students ____________ X 1 = Number of Sheets ______________

PAPER COST:

Number of sheets __________ of 20 pound blue paper EST. COST ______________

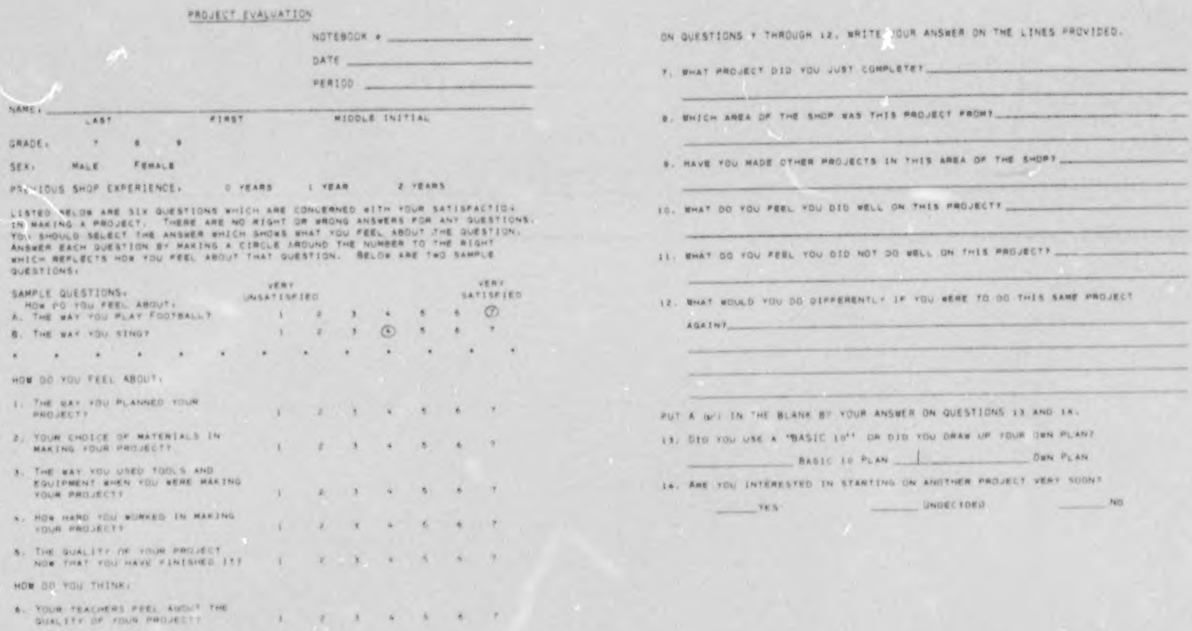
TIME: To order, type and print material cost record (250 per hour)

Number of sheets _____ ÷ __________ per hour = EST. TIME ______________

WORKSHEET # 11.7

PROJECT EVALUATION FORM

PURPOSE: Formal grading has been replaced by an evaluation instrument which is completed by the student. The teacher and student come together where assessment of accomplishment and learning growth is made.



PROJECT EVALUATION

NOTEBOOK # ____________
DATE ____________
PERIOD ____________

NAME: ______________________________
LAST FIRST MIDDLE INITIAL

GRADE: 7 8 9

SEX: MALE FEMALE

PREVIOUS SHOP EXPERIENCE: 0 YEARS 1 YEAR 2 YEARS

LISTED BELOW ARE SIX QUESTIONS WHICH ARE CONCERNED WITH YOUR SATISFACTION IN MAKING A PROJECT. THERE ARE NO RIGHT OR WRONG ANSWERS FOR ANY QUESTIONS. YOU SHOULD SELECT THE ANSWER WHICH SHOWS WHAT YOU FEEL ABOUT THE QUESTION. ANSWER EACH QUESTION BY MAKING A CIRCLE AROUND THE NUMBER TO THE RIGHT WHICH REFLECTS HOW YOU FEEL ABOUT THAT QUESTION. BELOW ARE TWO SAMPLE QUESTIONS:

SAMPLE QUESTIONS: HOW DO YOU FEEL ABOUT:	VERY UNSATISFIED						VERY SATISFIED
A. THE WAY YOU PLAY FOOTBALL?	1	2	3	4	5	6	[✓ 7]
B. THE WAY YOU SING?	1	2	3	[✓ 4]	5	6	7

* * * * * * * * * * * * *

HOW DO YOU FEEL ABOUT:							
1. THE WAY YOU PLANNED YOUR PROJECT?	1	2	3	4	5	6	7
2. YOUR CHOICE OF MATERIALS IN MAKING YOUR PROJECT?	1	2	3	4	5	6	7
3. THE WAY YOU USED TOOLS AND EQUIPMENT WHEN YOU WERE MAKING YOUR PROJECT?	1	2	3	4	5	6	7
4. HOW HARD YOU WORKED IN MAKING YOUR PROJECT?	1	2	3	4	5	6	7
5. THE QUALITY OF YOUR PROJECT NOW THAT YOU HAVE FINISHED IT?	1	2	3	4	5	6	7
HOW DO YOU THINK:							
6. YOUR TEACHERS FEEL ABOUT THE QUALITY OF YOUR PROJECT?	1	2	3	4	5	6	7

ON QUESTIONS 7 THROUGH 12, WRITE YOUR ANSWER ON THE LINES PROVIDED.

7. WHAT PROJECT DID YOU JUST COMPLETE? ____________

8. WHICH AREA OF THE SHOP WAS THIS PROJECT FROM? ____________

9. HAVE YOU MADE OTHER PROJECTS IN THIS AREA OF THE SHOP? ____________

10. WHAT DO YOU FEEL YOU DID WELL ON THIS PROJECT? ____________

11. WHAT DO YOU FEEL YOU DID NOT DO WELL ON THIS PROJECT? ____________

12. WHAT WOULD YOU DO DIFFERENTLY IF YOU WERE TO DO THIS SAME PROJECT AGAIN? ____________

PUT A (✓) IN THE BLANK BY YOUR ANSWER ON QUESTIONS 13 AND 14.

13. DID YOU USE A "BASIC 10" OR DID YOU DRAW UP YOUR OWN PLAN?
______ BASIC 10 PLAN ______ OWN PLAN

14. ARE YOU INTERESTED IN STARTING ON ANOTHER PROJECT VERY SOON?
______ YES ______ UNDECIDED ______ NO

COLOR CODING: The evaluation sheets are printed on goldenrod colored paper.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIALS: As the plan sheet, a student fills out an evaluation sheet for each project completed.

Number of students ________ X 10 will be a good supply to start with.

Number of Sheets ____________

PAPER COST:

Number of sheets ________ of 20 pound goldenrod paper

EST. COST ____________

TIME: To order paper, type and reproduce forms (500 per hour)

Number of sheets ________ ÷ ________ per hour = EST. TIME ____________

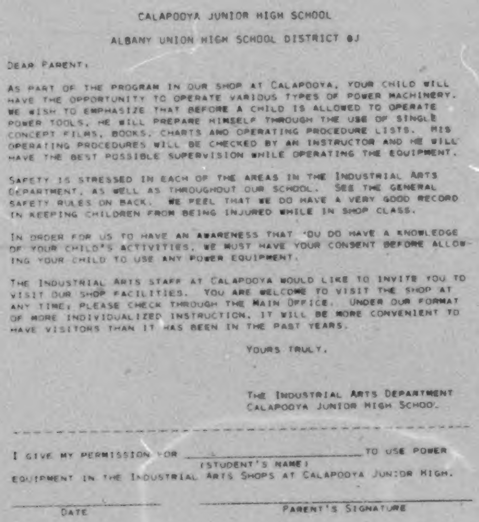
WORKSHEET # 11.8

PARENT PERMIT SLIP

PURPOSE: A parent permit slip is sent home with every student enrolled in the Career Exploration Program. The slip is sent home for the following reasons:

1. To inform parents of the program.
2. To inform parents that safety is stressed in the program.
3. To inform parents of their student's activities in the program.
4. To have the parents and student read over the shop safety rules, which are on the back page.
5. To have the parents sign the permit slip giving their son or daughter permission to use power equipment.

You can use this form by simply changing the school name or by making other revisions as you wish. The form should be filed in the student's notebook or in a file in the office.



CALAPOOYA JUNIOR HIGH SCHOOL

ALBANY UNION HIGH SCHOOL DISTRICT 8J

DEAR PARENT:

AS PART OF THE PROGRAM IN OUR SHOP AT CALAPOOYA, YOUR CHILD WILL HAVE THE OPPORTUNITY TO OPERATE VARIOUS TYPES OF POWER MACHINERY. WE WISH TO EMPHASIZE THAT BEFORE A CHILD IS ALLOWED TO OPERATE POWER TOOLS, HE WILL PREPARE HIMSELF THROUGH THE USE OF SINGLE CONCEPT FILMS, BOOKS, CHARTS AND OPERATING PROCEDURE LISTS. HIS OPERATING PROCEDURES WILL BE CHECKED BY AN INSTRUCTOR AND HE WILL HAVE THE BEST POSSIBLE SUPERVISION WHILE OPERATING THE EQUIPMENT.

SAFETY IS STRESSED IN EACH OF THE AREAS IN THE INDUSTRIAL ARTS DEPARTMENT, AS WELL AS THROUGHOUT OUR SCHOOL. SEE THE GENERAL SAFETY RULES ON BACK. WE FEEL THAT WE DO HAVE A VERY GOOD RECORD IN KEEPING CHILDREN FROM BEING INJURED WHILE IN SHOP CLASS.

IN ORDER FOR US TO HAVE AN AWARENESS THAT YOU DO HAVE A KNOWLEDGE OF YOUR CHILD'S ACTIVITIES, WE MUST HAVE YOUR CONSENT BEFORE ALLOWING YOUR CHILD TO USE ANY POWER EQUIPMENT.

THE INDUSTRIAL ARTS STAFF AT CALAPOOYA WOULD LIKE TO INVITE YOU TO VISIT OUR SHOP FACILITIES. YOU ARE WELCOME TO VISIT THE SHOP AT ANY TIME; PLEASE CHECK THROUGH THE MAIN OFFICE. UNDER OUR FORMAT OF MORE INDIVIDUALIZED INSTRUCTION, IT WILL BE MORE CONVENIENT TO HAVE VISITORS THAN IT HAS BEEN IN THE PAST YEARS.

YOURS TRULY,

THE INDUSTRIAL ARTS DEPARTMENT
CALAPOOYA JUNIOR HIGH SCHOOL

- -

I GIVE MY PERMISSION FOR ______________________ TO USE POWER
(STUDENT'S NAME)
EQUIPMENT IN THE INDUSTRIAL ARTS SHOPS AT CALAPOOYA JUNIOR HIGH.

______________ DATE

______________________ PARENT'S SIGNATURE

COLOR CODING: The parent permit slip is printed on white paper.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL:

Number of students __________ x 1 = Number of sheets ____________________

PAPER COST:

Number of sheets __________ of 20 pound white paper EST. COST ______________

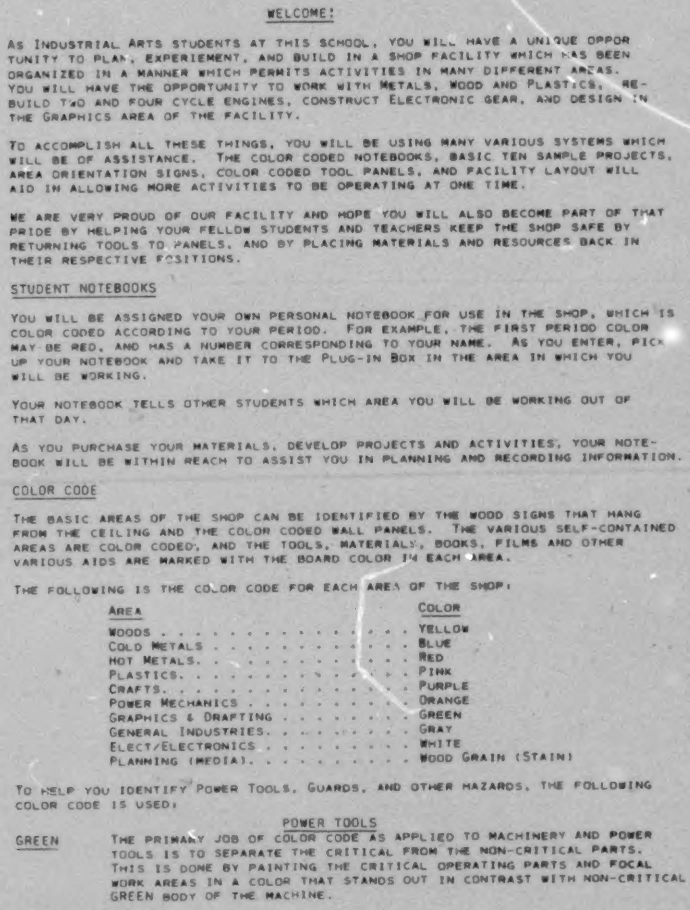
TIME: To order, type and print form (500 per hour)

Number of sheets ________ ÷ ______ per hour EST. TIME ______________

WORKSHEET # 11.9

WELCOME AND ORIENTATION SHEETS

PURPOSE: The purpose of an orientation for the students is two-fold. One is to give all students the same basic information. This establishes a consistency in the directions given to students. Each item considered to be important in assisting the students working toward their goal is included in this orientation. The second purpose is to help new students get a quick start toward their goals with a minimum of orientation. Staff can also use this form as an effective means of assessing reading skills.



WELCOME!

AS INDUSTRIAL ARTS STUDENTS AT THIS SCHOOL, YOU WILL HAVE A UNIQUE OPPORTUNITY TO PLAN, EXPERIEMENT, AND BUILD IN A SHOP FACILITY WHICH HAS BEEN ORGANIZED IN A MANNER WHICH PERMITS ACTIVITIES IN MANY DIFFERENT AREAS. YOU WILL HAVE THE OPPORTUNITY TO WORK WITH METALS, WOOD AND PLASTICS, REBUILD TWO AND FOUR CYCLE ENGINES, CONSTRUCT ELECTRONIC GEAR, AND DESIGN IN THE GRAPHICS AREA OF THE FACILITY.

TO ACCOMPLISH ALL THESE THINGS, YOU WILL BE USING MANY VARIOUS SYSTEMS WHICH WILL BE OF ASSISTANCE. THE COLOR CODED NOTEBOOKS, BASIC TEN SAMPLE PROJECTS, AREA ORIENTATION SIGNS, COLOR CODED TOOL PANELS, AND FACILITY LAYOUT WILL AID IN ALLOWING MORE ACTIVITIES TO BE OPERATING AT ONE TIME.

WE ARE VERY PROUD OF OUR FACILITY AND HOPE YOU WILL ALSO BECOME PART OF THAT PRIDE BY HELPING YOUR FELLOW STUDENTS AND TEACHERS KEEP THE SHOP SAFE BY RETURNING TOOLS TO PANELS, AND BY PLACING MATERIALS AND RESOURCES BACK IN THEIR RESPECTIVE POSITIONS.

STUDENT NOTEBOOKS

YOU WILL BE ASSIGNED YOUR OWN PERSONAL NOTEBOOK FOR USE IN THE SHOP, WHICH IS COLOR CODED ACCORDING TO YOUR PERIOD. FOR EXAMPLE, THE FIRST PERIOD COLOR MAY BE RED, AND HAS A NUMBER CORRESPONDING TO YOUR NAME. AS YOU ENTER, PICK UP YOUR NOTEBOOK AND TAKE IT TO THE PLUG-IN BOX IN THE AREA IN WHICH YOU WILL BE WORKING.

YOUR NOTEBOOK TELLS OTHER STUDENTS WHICH AREA YOU WILL BE WORKING OUT OF THAT DAY.

AS YOU PURCHASE YOUR MATERIALS, DEVELOP PROJECTS AND ACTIVITIES, YOUR NOTEBOOK WILL BE WITHIN REACH TO ASSIST YOU IN PLANNING AND RECORDING INFORMATION.

COLOR CODE

THE BASIC AREAS OF THE SHOP CAN BE IDENTIFIED BY THE WOOD SIGNS THAT HANG FROM THE CEILING AND THE COLOR CODED WALL PANELS. THE VARIOUS SELF-CONTAINED AREAS ARE COLOR CODED, AND THE TOOLS, MATERIALS, BOOKS, FILMS AND OTHER VARIOUS AIDS ARE MARKED WITH THE BOARD COLOR IN EACH AREA.

THE FOLLOWING IS THE COLOR CODE FOR EACH AREA OF THE SHOP:

AREA	COLOR
WOODS	YELLOW
COLD METALS	BLUE
HOT METALS	RED
PLASTICS	PINK
CRAFTS	PURPLE
POWER MECHANICS	ORANGE
GRAPHICS & DRAFTING	GREEN
GENERAL INDUSTRIES	GRAY
ELECT/ELECTRONICS	WHITE
PLANNING (MEDIA)	WOOD GRAIN (STAIN)

TO HELP YOU IDENTIFY POWER TOOLS, GUARDS, AND OTHER HAZARDS, THE FOLLOWING COLOR CODE IS USED:

POWER TOOLS

GREEN THE PRIMARY JOB OF COLOR CODE AS APPLIED TO MACHINERY AND POWER TOOLS IS TO SEPARATE THE CRITICAL FROM THE NON-CRITICAL PARTS. THIS IS DONE BY PAINTING THE CRITICAL OPERATING PARTS AND FOCAL WORK AREAS IN A COLOR THAT STANDS OUT IN CONTRAST WITH NON-CRITICAL GREEN BODY OF THE MACHINE.

COLOR CODING: The sheets are printed on white paper.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL: The sheets consist of threepages with printing on both sides of the first three pages. You may wish to revise these sheets to suit your particular needs. If you collect these sheets at the end of the year you will be able to use them for two or three years.

Number of students __________ x (3 sheets) = Number of Sheets __________

PAPER COST:

Number of sheets __________ of 20 pound white paper EST. COST __________

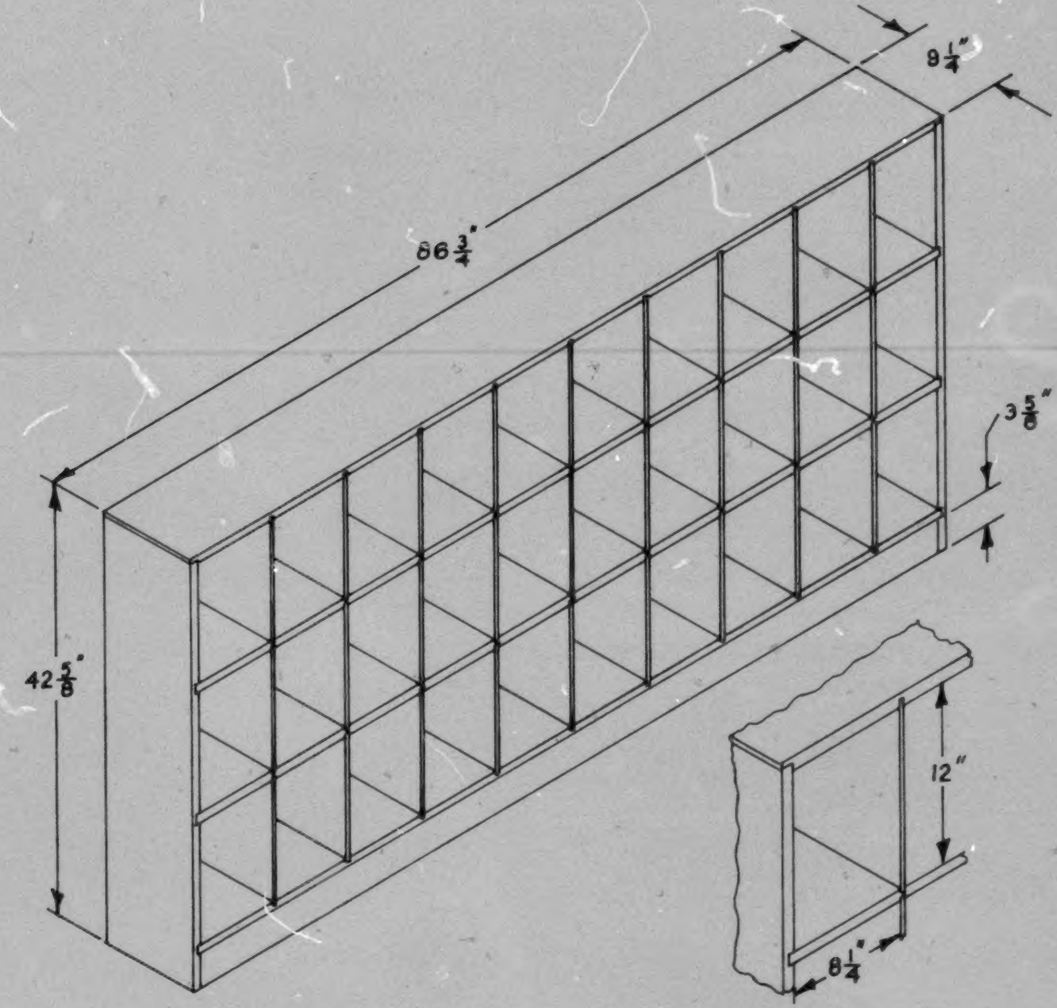
TIME: Type 3 sheets (both sides) and reproduce (1,000 copies per hour)

Number of sheets ________ ÷ ________ per hour = EST. TIME __________

WORKSHEET # 11.10

NOTEBOOK RACK

PURPOSE: Each facility has a storage rack for the care of the student management notebooks. This is normally situated near the main entrance. Each student in the program has his or her own notebook which contains an attendance sheet, performance record, equipment checkout sheet, cost sheet, plan sheets and orientation sheets. The rack itself is designed for ease of accessibility and convenience in taking class roll. The notebook rack is designed to accomodate one notebook for each student enrolled in class. Each period has a different color. For example, if you have a 7 period student day and you have a staff of three teachers working with 75 students per period, then you would need a notebook rack with a minimum of 75 slots, each containing 7 different colored notebooks.



COLOR CODING: None required. The notebook rack is usually finished with a wood stain.

VENDOR I.D. #: 34, 36, 37

BILL OF MATERIALS: Listed below are the materials required to build the notebook rack shown by the sketch. This rack has 30 slots and each slot contains 7 notebooks, or space for 210 notebooks.

# PCS.	NAME	T	W	L	MATERIAL
2	Sides	3/4"	9 1/4"	42 1/8"	Fir Plywood
1	Top	3/4"	9 1/4"	86 3/4"	Fir Plywood
3	Shelves	3/4"	9"	86"	Fir Plywood
24	Dividers	1/4"	9"	12 1/2"	Masonite
1	Back	1/4"	38 5/8"	86"	Masonite
2	F & B Kickboard	1 5/8"	3 5/8"	85 1/4"	Fir
2	Side Kickboards	1 5/8"	3 5/8"	6"	Fir
6	Hort. Booking	1/4"	3/4"	86 3/4"	Alder
6	Vert. Booking	1/4"	3/4"	12"	Alder
2	Vert. Booking	1/4"	3/4"	3 5/8"	Alder

MATERIAL COSTS: Use this space to figure material cost.

EST. COST ______________

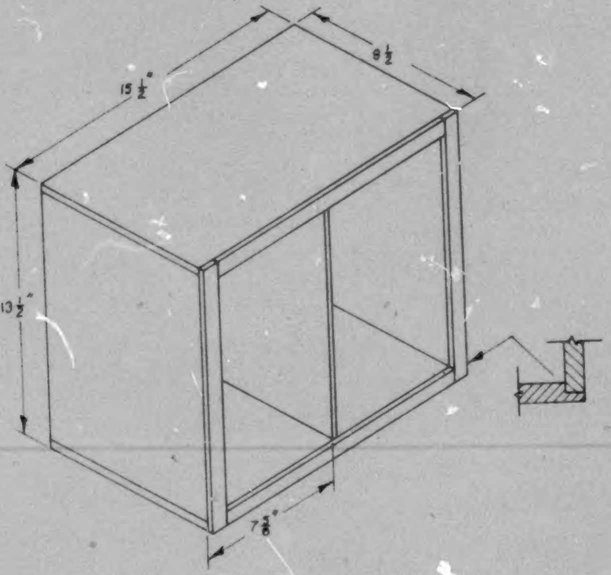
TIME: To construct and finish notebook rack for your facility (8 hours for notebook rack to house 450 notebooks).

EST. TIME ______________

WORKSHEET # 11.11

PLUG-IN BOX

PURPOSE: Upon removing their management notebook from the rack, the students take it to one of the different activity areas in the shop. Each of these areas has its own plug-in boxes where students can store their notebooks while working in that particular area. Since the boxes are located in an area, it is convenient for the students and teachers to refer to the notebook. Having the plug-in boxes keeps the notebooks off the benches and saves wear and tear on the notebooks. The plan provided will house 10-12 student notebooks.



COLOR CODING: We have used two methods of color coding the plug-in boxes. One is to paint just the facing strip the area color. The second method is to paint the complete box on the outside.

VENDOR I.D. #: 34, 37

BILL OF MATERIALS:

# PCS.	NAME	T	W	L	MATERIAL
2	Top and Bottom	3/4"	9 1/4"	15 1/2"	Fir Plywood
2	Sides	3/4"	9 1/4"	12 3/4"	Fir Plywood
1	Divider	1/4"	9"	12 3/4"	Masonite
1	Back	1/4"	12 3/4"	14 3/4"	Masonite
1	Facing	1/4"	3/4"	56"	Alder

MATERIAL COST:

Number Required ____________ @ Cost ______________ EST. COST ______________

TIME:

To construct one or more plug-in boxes for each activity area (1 per hour)

Number boxes __________ ÷ _____209_____ per hour = EST. TIME ______________

WORKSHEET # 12

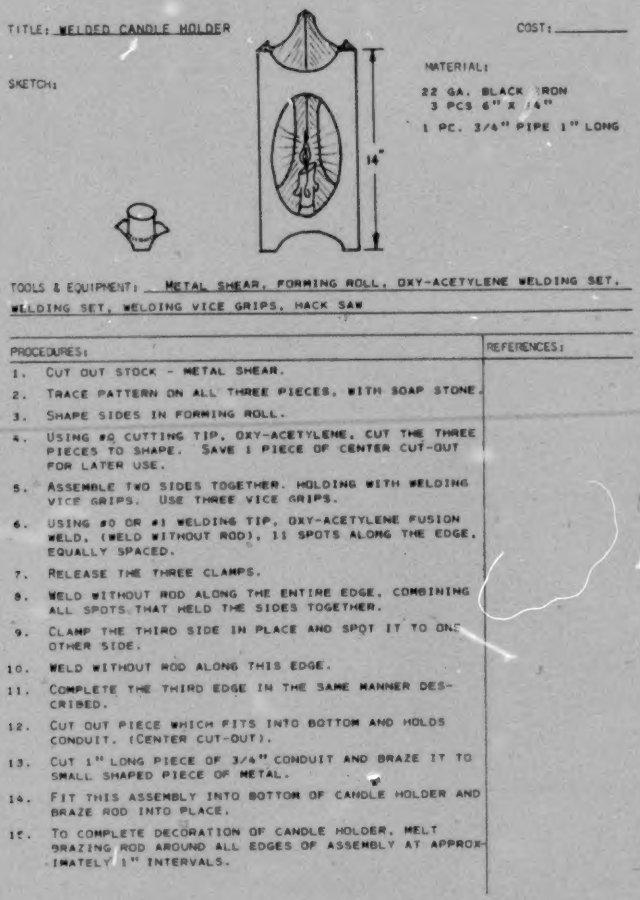
SELF-INSTRUCTION SYSTEM

PURPOSE: All of the instructional materials that are housed in the shop to help the student acquire the information needed to achieve his or her learning goals are considered part of the self-instruction system. The worksheets in Series 12 are concerned with the wide range of materials and equipment that relate to self-instruction. The exception to this is the books. Since the lists of books are so extensive, it was decided to place books and book storage in worksheet Series 13.

WORKSHEET # 12.1

BASIC 10 SHEETS

PURPOSE: The purpose of Basic 10 Projects is one of the most important steps in setting up a Career Exploration program. Once you know what your Basic 10 projects are going to be, you will make decisions about project materials, hand tools and reference materials that you will need. You will find some suggested Basic 10 sheets at the end of this publication. You may also obtain other Basic 10 ideas on your visits to the model sites.



TITLE: WELDED CANDLE HOLDER

COST: ________

SKETCH:

MATERIAL:
22 GA. BLACK IRON
3 PCS 6" X 14"
1 PC. 3/4" PIPE 1" LONG

TOOLS & EQUIPMENT: METAL SHEAR, FORMING ROLL, OXY-ACETYLENE WELDING SET, WELDING SET, WELDING VICE GRIPS, HACK SAW

PROCEDURES:	REFERENCES:
1. CUT OUT STOCK - METAL SHEAR.	
2. TRACE PATTERN ON ALL THREE PIECES, WITH SOAP STONE.	
3. SHAPE SIDES IN FORMING ROLL.	
4. USING #0 CUTTING TIP, OXY-ACETYLENE, CUT THE THREE PIECES TO SHAPE. SAVE 1 PIECE OF CENTER CUT-OUT FOR LATER USE.	
5. ASSEMBLE TWO SIDES TOGETHER. HOLDING WITH WELDING VICE GRIPS. USE THREE VICE GRIPS.	
6. USING #0 OR #1 WELDING TIP, OXY-ACETYLENE FUSION WELD, (WELD WITHOUT ROD), 11 SPOTS ALONG THE EDGE, EQUALLY SPACED.	
7. RELEASE THE THREE CLAMPS.	
8. WELD WITHOUT ROD ALONG THE ENTIRE EDGE, COMBINING ALL SPOTS THAT HELD THE SIDES TOGETHER.	
9. CLAMP THE THIRD SIDE IN PLACE AND SPOT IT TO ONE OTHER SIDE.	
10. WELD WITHOUT ROD ALONG THIS EDGE.	
11. COMPLETE THE THIRD EDGE IN THE SAME MANNER DESCRIBED.	
12. CUT OUT PIECE WHICH FITS INTO BOTTOM AND HOLDS CONDUIT. (CENTER CUT-OUT).	
13. CUT 1" LONG PIECE OF 3/4" CONDUIT AND BRAZE IT TO SMALL SHAPED PIECE OF METAL.	
14. FIT THIS ASSEMBLY INTO BOTTOM OF CANDLE HOLDER AND BRAZE ROD INTO PLACE.	
15. TO COMPLETE DECORATION OF CANDLE HOLDER, MELT BRAZING ROD AROUND ALL EDGES OF ASSEMBLY AT APPROXIMATELY 1" INTERVALS.	

COLOR CODING: The Basic 10 sheets are printed on colored paper to match the activity area color.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL: You may need to contact a printer in your area to find out where to order the different colors of paper you will require.

Activity Area	Color Paper	Amount	Cost

PAPER COST:

EST. COST ____________________

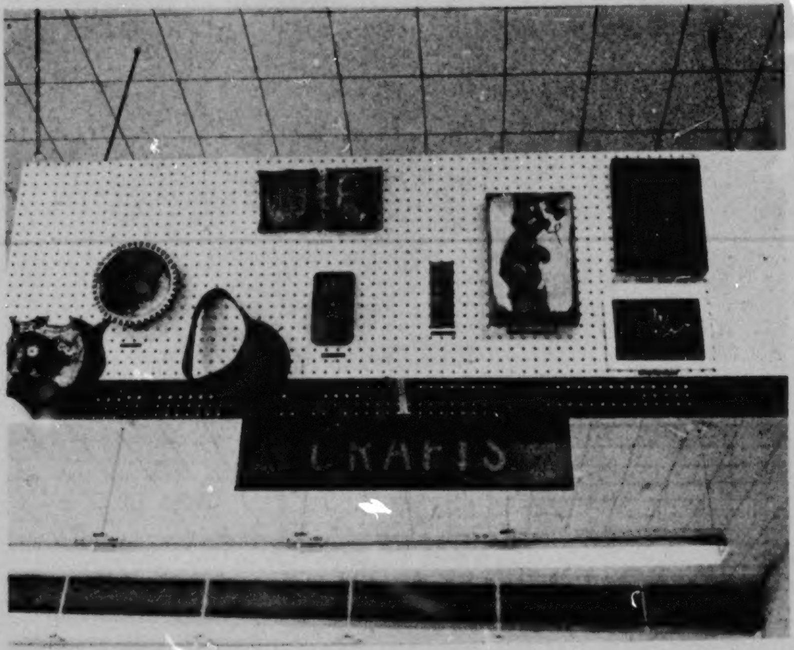
TIME: To select Basic 10 projects and order paper (1 hour per activity area)

Number of Activity Areas ________ X ______ per hour= EST. TIME ____________________

WORKSHEET # 12.2

BUILDING BASIC 10 PROJECTS

PURPOSE: You should have already selected the Basic 10 project ideas you will include in your program. It is strongly suggested that you use the Basic 10's that have already been developed because it would take at least seven hours of your own time to develop an original Basic 10 that is satisfactory. Once your program grows, you will have the time to develop your own Basic 10's if you wish. You, the instructor, will learn a lot by building the Basic 10 projects to be displayed in the shop. Remember, if you have a difficult time completing one of the steps required in making the project, the student will have even more difficulty. This experience will also help you suggest reference materials. You may find out you will have to build a special jig or develop an instruction sheet so students can be assured of success in building the project.



COLOR CODING: None

VENDOR I.D. #: 21, 28, 36, 37, 52

BILL OF MATERIAL: Look at the material section of each Basic 10 sheet to determine the material you will need to build the Basic 10 project.

MATERIAL LIST	SUPPLIER	COST

MATERIAL COST:

EST. COST ____________________

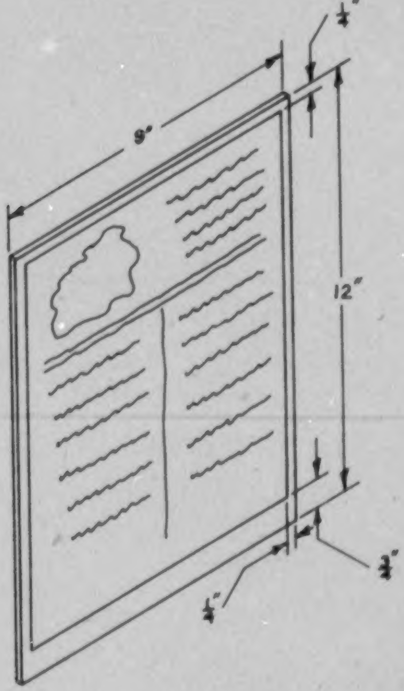
TIME: To build Basic 10 projects (2 projects per hour).

Number of projects ____________ ÷ ________ per hour = EST. TIME ____________________

WORKSHEET # 12.3

MOUNTING BASIC 10 SHEETS

PURPOSE: Since each activity area of the shop has at least 10 sample projects on display for students to select and build, we must have the instructions for construction of each project at hand for students to copy. These instructions are the Basic 10 Plan Sheets. If you attach these Basic 10 sheets to masonite, they don't become lost, damaged or folded. This will also provide a method of displaying the Basic 10 Sheets (Worksheet 12.4).



COLOR CODING: The paper the Basic 10 sheets are printed on should be the same color as the activity area.

VENDOR I.D. #: 21, 37, 49

BILL OF MATERIAL:

1 holder 1/8" x 9" x 12", Masonite tempered, both sides

At least 10 holders for each activity area.

Hardware - Rubber cement and Brayer

MATERIAL COST:

Number of holders ________@ Cost _______________ = EST. COST __________________

You will have to figure the number of 4' x 8' sheets of masonite you will need to determine the cost.

TIME: To cut masonite and glue on Basic 10 sheets (10 holders per hour).

Number of holders ____________ ÷ _________per hour=EST. TIME ________________

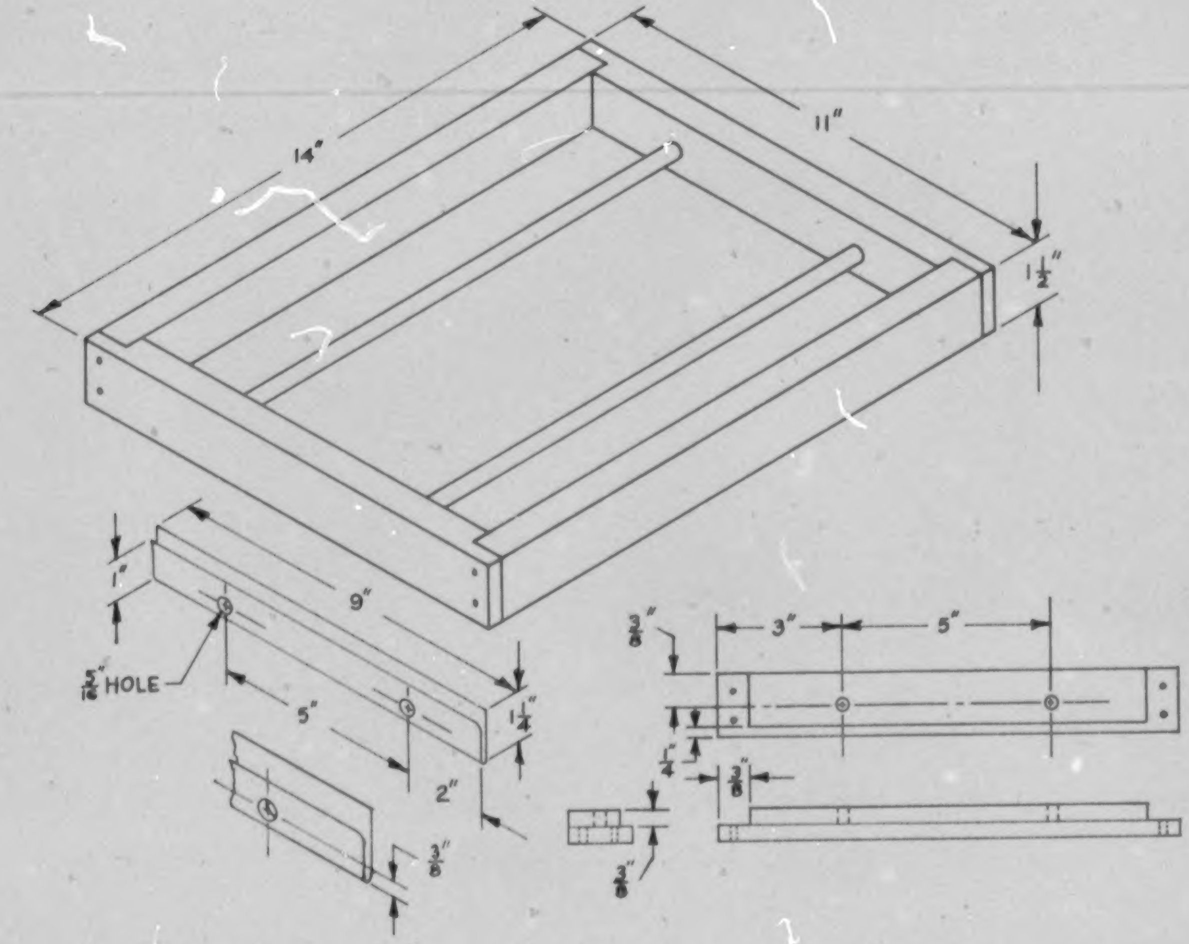
WORKSHEET # 12.4

BASIC 10 HOLDER

PURPOSE: This holder was designed to display the mounted Basic 10 plan sheets. As you recall, the Basic 10 sheets are the instructions for making the 10 sample projects which are displayed in each activity area of the shop. This design was selected for the following reasons:

1. It doesn't take up too much space.
2. Students can see the sketches on the Basic 10 sheets without removing them from the holder.
3. You can add more Basic 10 sheets easily by removing 4 wood screws in the front of the holder.
4. Students can remove the Basic 10 sheets from the holder if they wish to copy the instructions onto their plan sheets.
5. It is convenient for students because they know where to look for project ideas and where to store them when they are finished using them.

You may wish to design your own holder, but try to provide for the flexibility suggested above.



COLOR CODING: Paint the holders the color of the activity area in which they will be placed.

VENDOR I.D. #: 36, 37

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
2	Sides	3/4"	1 1/2"	13 1/4"	Fir or Pine
2	Ends	3/4"	1 1/2"	11"	Fir or Pine
2	Rods	1/4"dia.		13 1/4"	Metal Rod
10	Clips	22 Ga.	2 1/2"	9"	Galv. Sheet Metal
1	Bottom	1/4"	10 1/4"	13 1/4"	Masonite

Hardware - 8 wood screws, finish nails, glue and paint

MATERIAL COST:

Number of holders ________@ Cost ______________ = EST. COST ______________
(Activity Areas)

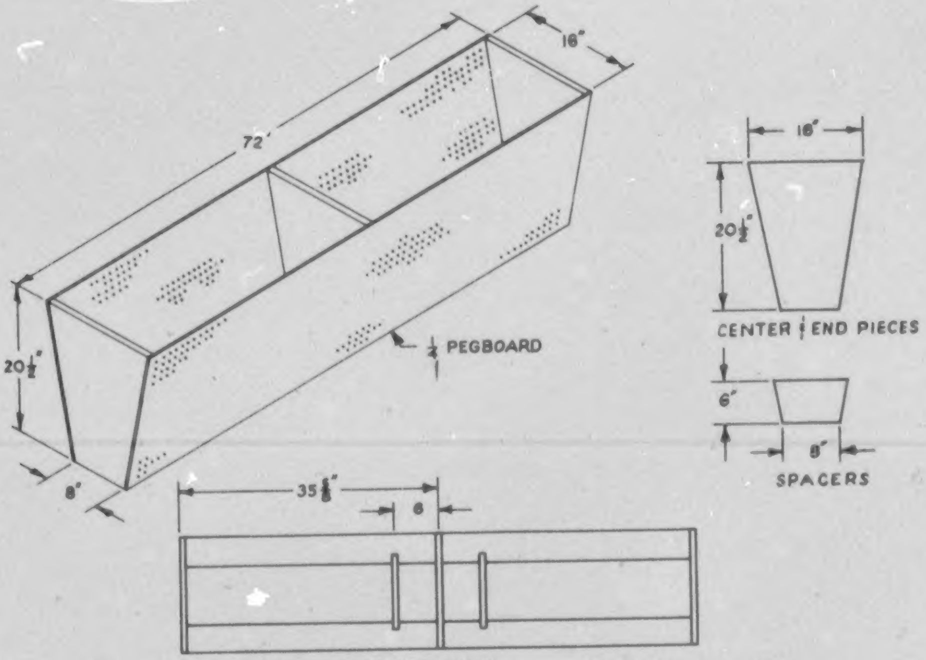
TIME: To construct holder for each area (one holder per hour)

Number of holders ________ ÷ ____________ per hour = EST. TIME ______________
(Activity Areas)

WORKSHEET # 12.5

BASIC 10 PROJECT HOLDER

PURPOSE: To display sample projects in each area of the shop is the purpose of the Basic 10 project holder. The holder can also be used to display media or other instructional materials. The holder is attached by chain to the ceiling. Area signs (Worksheet 12.6) are attached to the bottom of the holders. Another method of displaying projects is to mount them on the top half of the media boards.



COLOR CODING: Two methods of color coding have been used. One is to paint the sides the area color and stain the ends a common color. Another is to paint the sides a base color white and then paint the end pieces the area color..

VENDOR I.D. #: 36, 37, 47

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
3	Ends and Center	3/4"	16"	20 1/2"	Fir Plywood
2	Sides	1/4"	21"	72"	Peg Board
2	Spacers	3/4"	6"	8"	Fir

Hardware - chain, 8 screw hooks and screw eyes for mounting area signs.

MATERIAL COST:

Number of holders (areas) ________ @ Cost __________ = EST. COST ________________

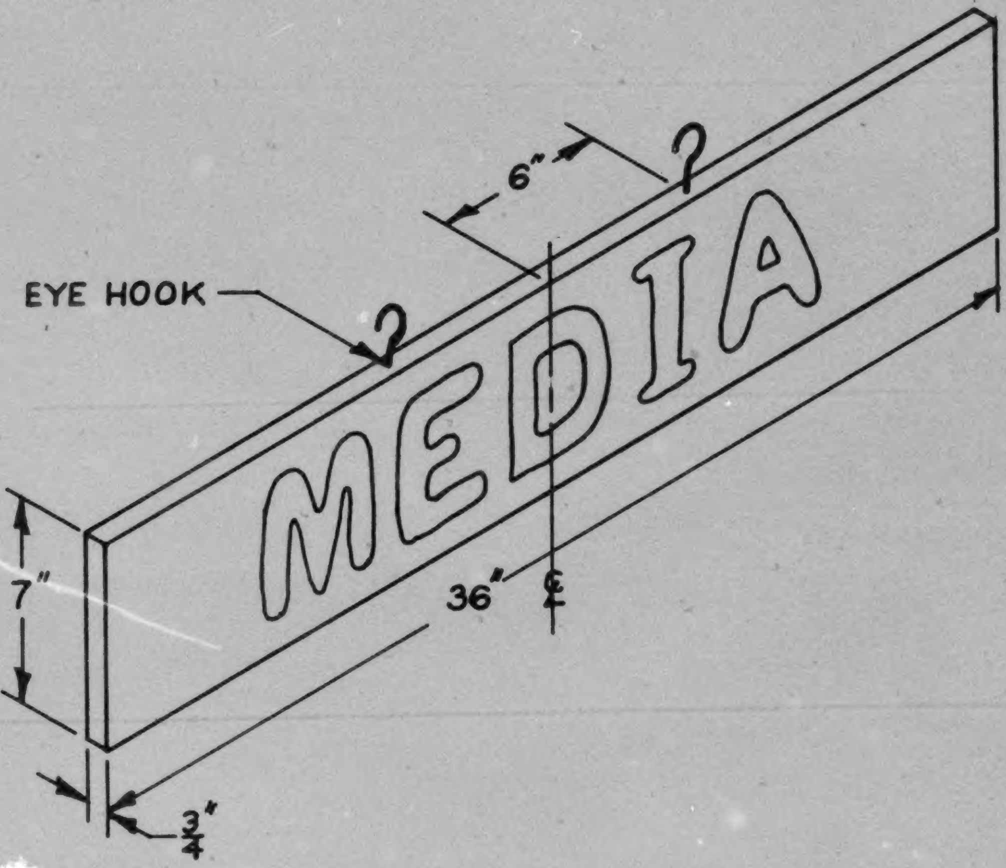
TIME: To build, finish, color code, mount Basic 10 projects and mount (2 hours per holder).

Number of holders________ X ________ hours = EST. TIME ________________

WORKSHEET # 12.6

AREA SIGNS

PURPOSE: To identify the different activity areas of the shop is the purpose of area signs. Another purpose is to improve safety in areas where machines are located by displaying signs that say "Wear Your Goggles" or "Machine Area".



COLOR CODING: Cut letters from area-colored contact paper or route-out letters and paint with area colored paint.

VENDOR I.D. #: 37, 47

BILL OF MATERIAL:

# PCS.	NAME	T	W	L	MATERIAL
1	Sign	3/4"	7"	36"	Pine
2	Screw Hooks				

MATERIAL COST:

Number of Signs (Areas) ________ @ Cost ____________ EST. COST

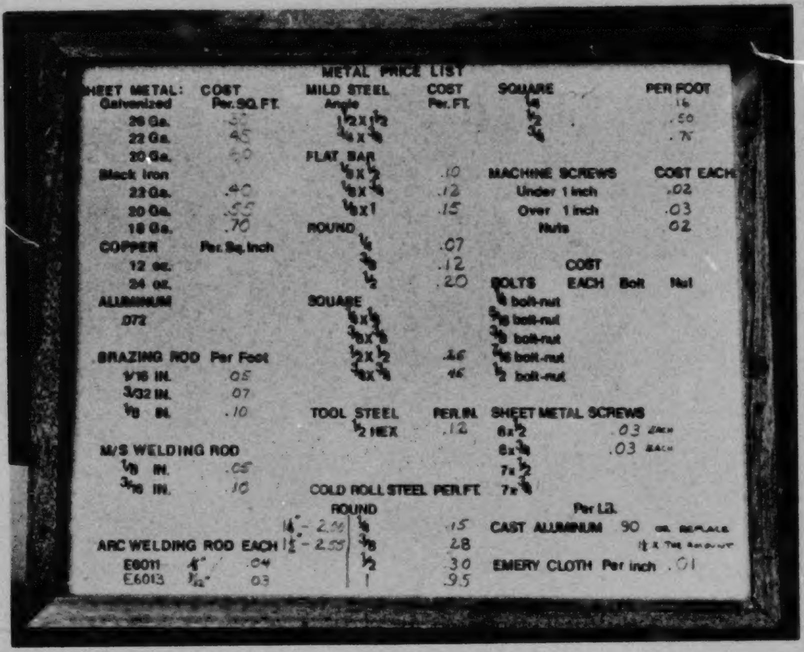
TIME: To build, color code and mount (one sign per hour).

Number of Signs ________ ÷ 220 per hour = EST. TIME ____________

WORKSHEET # 12.7

PRICE LISTS

PURPOSE: So that students can figure the costs of the many items needed to complete their projects, a price list is displayed in every activity area. Students not only can figure their costs, but can learn responsibility by managing materials.



METAL PRICE LIST

SHEET METAL: COST
Galvanized Per.SQ.FT.
26 Ga. .30
22 Ga. .45
20 Ga. .60
Black Iron
22 Ga. .40
20 Ga. .55
18 Ga. .70
COPPER Per.Sq.Inch
12 oz.
24 oz.
ALUMINUM
.072
BRAZING ROD Per Foot
1/16 IN. .05
3/32 IN. .07
1/8 IN. .10
M/S WELDING ROD
1/8 IN. .05
3/16 IN. .10
ARC WELDING ROD EACH
E6011 1/8" .04
E6013 3/32" .03

MILD STEEL COST Per.FT.
Angle
1/2 X 1/2
3/4 X 3/4
FLAT BAR
1/8 X 1/2 .10
1/8 X 3/4 .12
1/8 X 1 .15
ROUND
1/4 .07
3/8 .12
1/2 .20
SQUARE
1/4 X 1/4
3/8 X 3/8
1/2 X 1/2 .46
3/4 X 3/4 46
TOOL STEEL PER.IN.
1/2 HEX .12
COLD ROLL STEEL PER.FT.
ROUND
1 1/4" - 2.[illegible] 1/4 .15
1 1/2" - 2.55 3/8 .28
1/2 .30
1 .95

SQUARE PER FOOT
1/4 .16
1/2 .50
3/4 .75
MACHINE SCREWS COST EACH
Under 1 inch .02
Over 1 inch .03
Nuts .02
BOLTS COST EACH Bolt Nut
1/4 bolt-nut
5/16 bolt-nut
3/8 bolt-nut
7/16 bolt-nut
1/2 bolt-nut
SHEET METAL SCREWS
6x1/2 .03 EACH
6x3/4 .03 EACH
7x1/2
7x3/4
CAST ALUMINUM Per LB. 90 OR REPLACE 1½ X THE AMOUNT
EMERY CLOTH Per inch .01

COLOR CODING: The price list is displayed in the activity areas and need not be color coded. If the price lists are just typed on paper, the paper could be the same color as the activity area.

VENDOR I.D. #: 39, 54, 64

BILL OF MATERIAL: With today's changing price of material, try to design a price list that can be changed easily. No prices are listed on the main sheet but a place for the price is provided. A price list can be provided which contains every possible item that could be sold in an activity area. The price list is covered with a piece of plastic on which the prices are marked with a grease pencil. Space for the price will be left blank if the item is not in stock.

Design price lists and fill in the material needed.

# PRICE LISTS	MATERIAL	SUPPLIER	COST

MATERIAL COST:

EST. COST ____________________

TIME: Cut material, label, identify cost and finish (3 hours per list).

Number of lists __________ X ______________ hours = EST. TIME ____________________

WORKSHEET # 12.8

EQUIPMENT OPERATION NOTEBOOKS

PURPOSE: The operating procedures recommended by the staff are contained in the Power notebooks for use by the students. It is to these books that most students come to prepare themselves in the operation of the equipment. An integral part of the notebook is the media reference list which contains all the loop, book and other media available to assist the student in gaining knowledge in the operation of equipment.

COLOR CODING: In most shops, notebooks used to house the procedures for equipment use are colored orange, and an effort is made to use a color other than that used for student notebooks.

VENDOR I.D. #: 29, 40

BILL OF MATERIAL: A notebook should be ordered for every piece of equipment in your shop. This includes portable power tools as well as stationary equipment. It is a good idea to order a few extra notebooks.

Number of pieces of equipment ________ X 1 = Number of Notebooks __________

MATERIAL COST:

Number of notebooks _______ @ Cost _____________ = EST. COST ______________

TIME: To order and label (6 notebooks per hour)

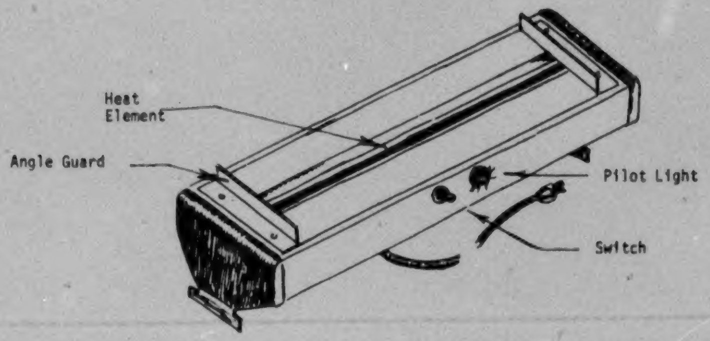
Number of notebooks _______ ÷ __________ per hour =EST. TIME ______________

WORKSHEET # 12.9

EQUIPMENT OPERATION SHEETS

PURPOSE: Students in the Career Exploration program are provided a wide selection of media so they can learn the safe operating procedures of power equipment operation. One such source of information is the equipment operation sheets. These sheets are contained in a notebook prepared for each specific piece of power equipment (Worksheet 12.8). These sheets, which are contained in the appendix (page D-3), give the use and safety procedure for each piece of power equipment in the shop. To begin with, use the forms as provided. Then when you are working with the forms and find that certain steps don't suit you, simply cross out and write the new steps in ink above the old step. The following summer, go over the sheets and retype them to suit your program.

A reference sheet (page D-2) is also included in each equipment operations notebook. Other sources of information about the particular piece of equipment are listed on the reference sheet including film loops, filmstrips, books and charts.



STRIP HEATER

USES: TO BEND UP TO 1/4" PLASTIC.

SAFETY PROCEDURE:

1. DO NOT LEAVE MACHINE WHEN POWER IS ON.
2. WEAR SAFETY GLASSES OR GOGGLES.
3. TURN OFF SWITCH AND REPLACE GUARD BEFORE LEAVING MACHINE.
4. WHEN HANDLING PLASTIC THAT HAS BEEN HEATED, ALWAYS WEAR GLOVES.

OPERATING PROCEDURE:

1. REMOVE MASKING PAPER ALONG THE LINE TO BE HEATED.
2. PLACE THE PLASTIC WITH THE BENDING LINE DIRECTLY OVER HEATING ELEMENT.
3. PROPERLY HEAT PLASTIC. THE PLASTIC WILL SOFTEN AND SAG AS IT NEARS THE PROPER TEMPERATURE. WITH PLASTIC OVER 1/16" THICK IT MAY BE NECESSARY TO TURN AND WARM OTHER SIDE.
4. REMOVE PLASTIC AND BEND BY HAND ALONG HEATED LINE.
5. HOLD IN PROPER POSITION UNTIL COOL. IT MAY TAKE SEVERAL MINUTES.

COLOR CODING: The equipment operation sheets are printed on goldenrod paper.

VENDOR I.D. #: 39, 40, 54, 64

BILL OF MATERIAL: In most programs, these sheets are placed in plastic folders to protect them from heavy student use.

1 ream goldenrod paper @ ________

________ plastic folders @______

MATERIAL COST: Add up the paper and plastic folder cost.

EST. COST__________________

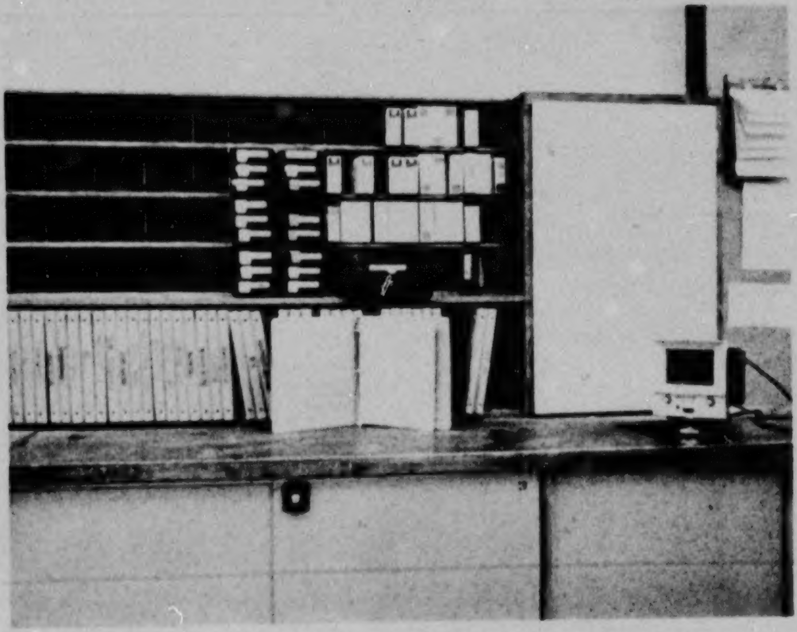
TIME: To list references, type and make copies of each sheet and label each notebook (2 per hour).

Number of Equipment Notebooks______ ÷ ____per hr.=EST. TIME ________________

WORKSHEET # 12.10

EQUIPMENT OPERATION NOTEBOOK STORAGE

PURPOSE: The equipment Operation Notebooks were discussed in Worksheet 12.8. A place to house the equipment notebooks should be constructed. These storage units can be placed in the planning areas or close to the machine areas.



COLOR CODING: None

VENDOR I.D. #: 36, 37

BILL OF MATERIAL: You will need to figure out the number of notebooks to be housed. Count the number of pieces of stationary equipment and electric portable tools to determine the size of storage rack.

MATERIAL COST:

Number of Racks ____________ @ Cost ____________ = EST. COST ______________

TIME: To design, build and finish equipment notebook storage cabinet (2 hours).

Number of Racks ________ X _________ per hour = EST. TIME ________________

WORKSHEET # 12.11

EQUIPMENT COLOR CODING

PURPOSE: To help you identify stationary equipment, power tools, guards, switches and other hazards, the following color code is used.

STATIONARY EQUIPMENT & POWER TOOLS

GREEN The primary job of color code as applied to machinery and power tools is to separate the critical from the non-critical parts. This is done by painting the critical operating parts and focal work areas in a color that stands out in contrast with non-critical green body color of the machine.

GUARDS & SWITCHES

ORANGE Moving parts on machines can be a safety hazard. To minimize this hazard, any moving parts such as guards and switches are painted a bright orange for instant recognition.

CONTROLS

YELLOW The controls of a machine are painted a bright yellow to command attention to making adjustments. The controls that are not painted yellow inform the students that they are not allowed to make adjustments.

WATCH OUT

YELLOW Around each stationary machine and any area that special consideration should be given to safety, a wide yellow line of tape or paint should be marked on the floor. All students should stay out of this area unless they are operating the equipment or learning how the equipment is used. All students in this area should wear goggles or other eye protection at all times.

VENDOR I.D. #: 36, 38

BILL OF MATERIAL:

Paint Color	No. Gallons	@	Cost
Green			
Yellow			
Orange			

Other supplies needed: Paint brushes, thinner, spray gun, containers, etc.

MATERIAL COST:

EST. COST ____________

TIME: To color code all stationary equipment (2 hours for each piece of equipment).

Number of pieces of equipment _____ X ______ hours = EST. TIME ____________

WORKSHEET # 12.12

EQUIPMENT IDENTIFICATION

PURPOSE: So that beginning students can tell the name of one piece of equipment from another, each piece of equipment has a name tag fastened to it. Another reason for equipment identification is so students can associate name with equipment and more readily find reference material about its use. Engraved name tags fastened with pop rivets or labeled tape have been the two methods used to identify equipment.

COLOR CODING: Orange label tape or engraving material is used.

VENDOR I.D. #: 7, 13, 40

BILL OF MATERIAL:

Number of pieces of Equipment ________

MATERIAL COST:

Amount of Material ________ @ ___________ = EST. COST ____________

TIME: Construct and mount equipment name tags (4 per hour).

Number of Pieces of Equipment __ ÷ __ per hour = EST. TIME ____________

WORKSHEET # 12.13

SINGLE-CONCEPT FILM LOOP LISTS

PURPOSE: To help students develop their own mode of operation, a variety of audio-visual material is suggested. You may purchase 8 MM film loops, sound or silent, with tape cassettes. Students are more likely to view film loops of machine operation than film loops about hand tools. Before you make your selection, you must preview the material. If the vendor will not send you the material to preview, look elsewhere to buy your film loops. Another important factor is the servicing of film loops. Before you purchase, find out where you can have the loops repaired, the average cost and how long it will take.

COLOR CODING: A good way to color code the film loops is to mark them with small rectangles of colored contact paper. If a film loop is about an operation in the Hot Metals area, for example, a rectangle of red contact paper for Hot Metals is placed on the film loop. Before the film loops are placed in use, put the film loop number on the cartridge with a hand engraver.

VENDOR I.D. #: 4, 6, 23, 56, 58, 60, 61

BILL OF MATERIAL: The following is a suggested list of film loops by activity area. The title of the film loop is listed but not the vendor or film number.

ON HAND	TITLE	SUPPLIER	FILM LOOP NUMBER	COST
	WOODS			
	Band Saw-Tension Guide and Assemblies			
	Band Saw Operation			
	Drill Press Bits			
	Drill Press Adjustments			
	Drill Press Operation			
	Scroll Saw Parts			
	Scroll Saw Tables Hold Down			
	Scroll Saw Operation			
	Wood Lathe Mounting the Face Plate			
	Wood Lathe Mounting Work Piece			
	Setting Up Wood Lathe			
	Centering Stock Wood Lathe			
	Mounting the Work on Wood Lathe			

ON HAND	TITLE	SUPPLIER	FILM LOOP NUMBER	COST
	WOODS (con't.)			
	Rough Turning			
	Cutting Curves, Grooves and Shoulders			
	PLASTICS			
	Forming			
	Shaping			
	Finishing			
	A Project in Plastics			
	Preparing for Laminating			
	Preparing the Mold			
	Lay Up Laminating			
	Removing the Mold			
	DRAFTING			
	Planning the Project			
	Drawing the Project			
	Planning Accessories and Finishes			
	COLD METALS			
	Measuring and Marking Tools			
	Introduction and Parts			
	Mounting Chucks and Types			
	Setting Up Work Between Centers			
	Turning Between Centers			
	Chucking Work			
	HOT METALS			
	Forge, Tongs and Anvil			
	Annealing and Hardening			
	Tempering			
	Twisting, Ball Peening and Finishing			

WORKSHEET # 12.13 (continued)

SINGLE-CONCEPT FILM LOOP LIST

ON HAND	TITLE	SUPPLIER	FILM LOOP NUMBER	COST
	HOT METALS (continued)			
	Welding Equipment			
	Setting Up, Lighting, Shutting Down			
	Make a Puddle, Running a Bead, Adding Filler			
	Cutting			
	Brazing			
	CRAFTS			
	The Swivel Knife			
	Simple Lacing Techniques			
	Designing with Nature Forms			
	Designing with Tools			
	Double Cordovan Stitch			
	Basic Leather Carving			

FILM LOOP COST: Add up the cost column and place total on Estimated Cost blank.

EST. COST ________________

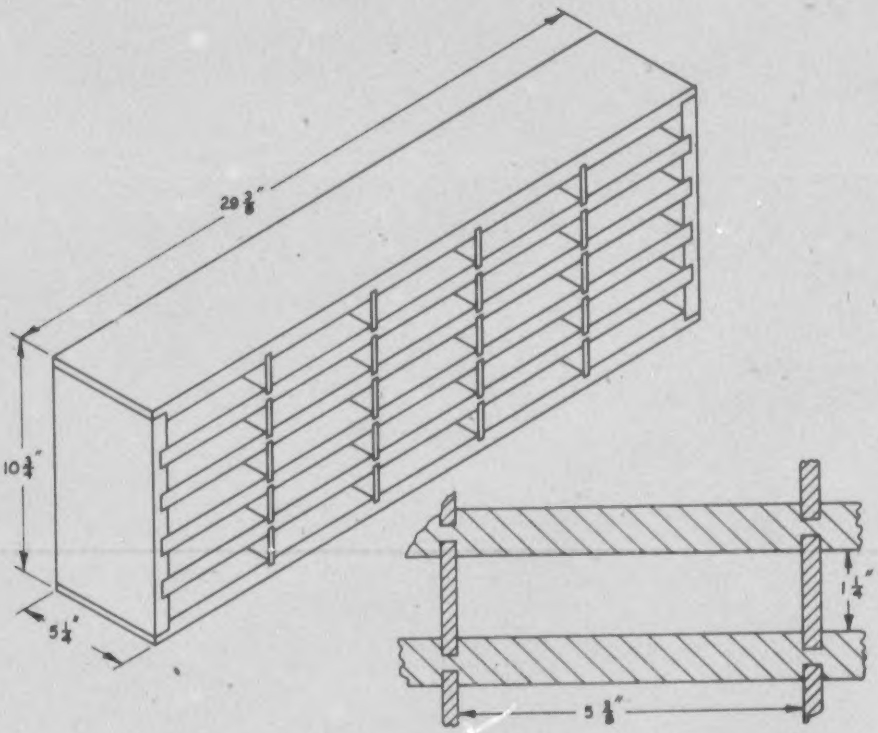
TIME: To preview, order, color code and label film loops (4 per hour).

Number of film loops ________ ÷ _______ per hour = EST. TIME ________________

WORKSHEET # 12.14

FILMLOOP RACK

PURPOSE: The rack sketched below was designed to hold 20 Sterling Sound Filmloops. You should measure your filmloop boxes before beginning construction. You must also count the number of filmloops you have on hand so you can determine the number of filmloop racks you will need. The racks are placed in the planning areas of the shop.



COLOR CODING: Paint the rack the color of the activity area in which it will be housed.

VENDOR I.D. #: 36, 37

BILL OF MATERIALS:

# PCS.	NAME	T	W	L	MATERIAL
2	Top and Bottom	3/4"	5 1/4"	29 3/8"	Fir Plywood
2	Sides	3/4"	5 1/4"	10"	Fir Plywood
4	Hort. Shelves	3/4"	5"	28 5/8"	Fir Plywood
20	Dividers	1/4"	1 3/4"	5"	Masonite
1	Back	1/4"	10"	28 5/8"	Masonite

MATERIAL COST:

Number of racks ________ @ __________ = EST. COST ____________

TIME: To design, build and finish Filmloop racks (3 hours per rack).

Number of Racks ______ X __________ hours = EST. TIME ____________

WORKSHEET # 12.15

FILM STRIP LIST

PURPOSE: Film loops, either sound or silent, have been used in most cases while film strips have been purchased to provide information not available on film loops. Whether to use film loops or film strips is up to you, but be sure that you preview before purchasing.

COLOR CODING: Cut a small rectangle of colored contact paper and place on each film strip (Worksheet 12.13).

VENDOR I.D. #: 4, 6, 11, 33, 45, 58

BILL OF MATERIAL: The following suggested film strips are listed by activity areas. The film strips listed can be purchased with cassette tapes.

ON HAND	TITLE	SUPPLIER	FILM STRIP NUMBER	COST
	HOT METALS			
	Striking an Arc			
	Running a Bead			
	Stopping and Restarting a Bead			
	Running a Bead with a 5/32 Inch Electrode			
	Bead Test Weaving			
	Welding Square Butt Joints			
	Welding Titles Tee Joints			
	Welding Lap Joints			
	Welding Horizontal Tee Joints			
	Welding Horizontal Lap Joints			
	Welding Horizontal Vee-Groove Butt Joints			
	Cutting, Burning and Grinding			
	WOODS			
	Straight Sawing			
	Curved Sawing and Drilling			
	Smoothing and Shaping			
	Sanding			

ON HAND	TITLE	SUPPLIER	FILM STRIP NUMBER	COST
	WOODS (con't.)			
	The Lathe-Spindle Turning			
	The Lathe-Face Plate Turning			
	Care and Use of the Jig Saw			
	Care and Use of the Circular Saw			
	Care and Use of the Band Saw			
	Care and Use of the Drill Press			
	Design in Wood			
	COLD METALS			
	Sheet Metal-Laying Out and Cutting			
	Sheet Metal-Forming and Seaming			
	Bench Metal Filing			
	Bench Metal Cutting			
	Bench Metal Drilling			
	CRAFTS			
	Art Metal-Making Trays and Bowls			

FILMSTRIP COST: Add up the Cost column and place figure in the Estimated Cost Column.

EST. COST ______________

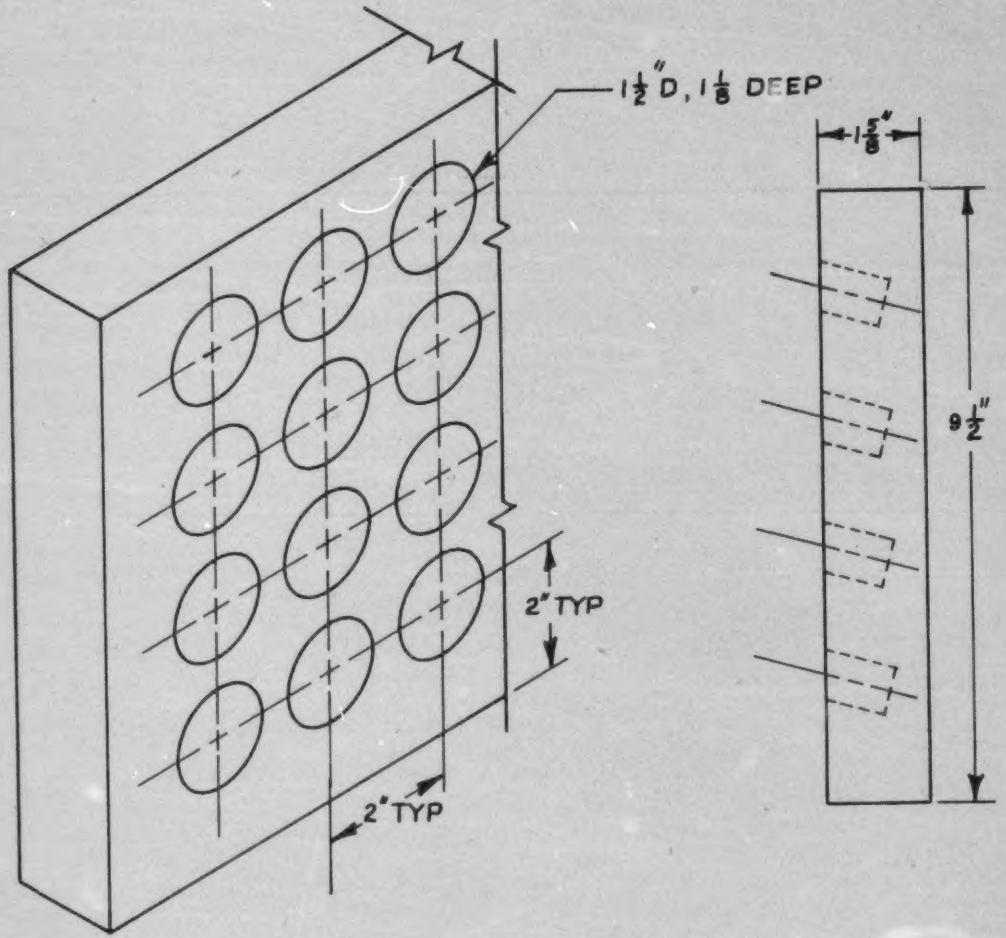
TIME: To preview, order, color code and label film strips (4 per hour).

Number of Filmstrips _______ ÷ ________ per hour = EST. TIME ______________

WORKSHEET # 12.16

FILMSTRIP RACK

PURPOSE: This rack is mounted in a media or planning area of the shops to display and store filmstrips. It should be located close to your filmstrip projectors for convenience.



COLOR CODING: If rack is mounted in an activity area, paint with the area color.

VENDOR I.D. #: 36, 37

BILL OF MATERIAL: You will have to determine the size you require.

MATERIAL COST:

Number of racks______________ @ Cost ____________ = EST. COST____________

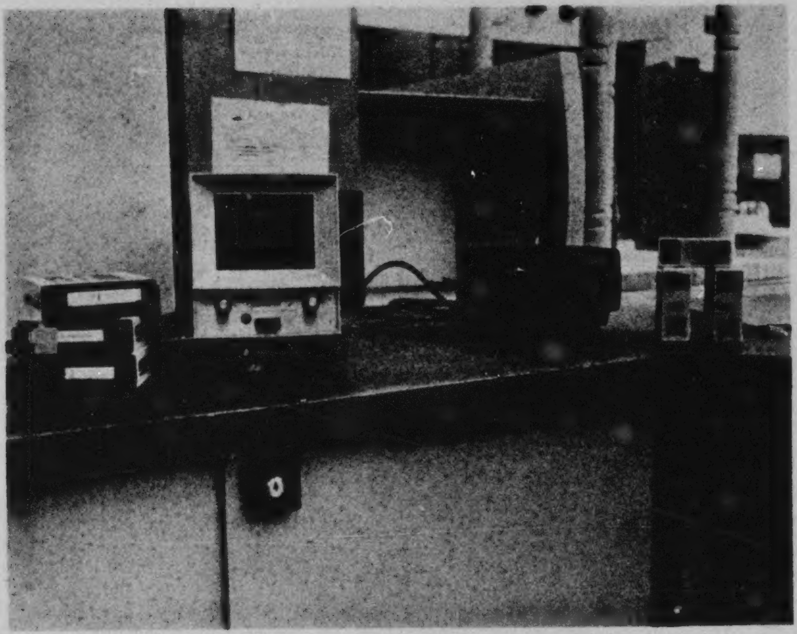
TIME: To design, build and finish filmstrip racks (2 hours per rack).

Number of racks _________ X _________ hours = EST. TIME ____________

WORKSHEET # 12.17

AUDIO VISUAL EQUIPMENT & MATERIALS

PURPOSE: The type of equipment you will need will be determined by the audio-visual materials you select for your program. If you select 8 MM filmloops (silent or sound), filmstrips, slide/tapes, or cassette tapes, this will determine the types of projection equipment needed. There are two important factors to remember in purchasing audio-visual equipment. First, students are going to use this equipment, so try to buy equipment that is as "kid proof" as possible. Second, consider the availability of servicing if you need repairs. And remember, always preview all audio visual equipment and materials.



COLOR CODING: Color coding is not required but engrave the serial numbers on the equipment as soon as possible.

VENDOR I.D. #: 4, 6, 11, 48, 56, 61

BILL OF MATERIALS: Pencil in the needed information to order equipment.

Type of Equipment	Supplier	Cost

EQUIPMENT AND MATERIAL COST

EST. COST ____________________

TIME: To preview, order and label AV equipment (2 hours for each type of equipment).

Number of types of equipment _____ X ________ hours = EST. TIME ____________________

WORKSHEET # 13

BOOK LISTS AND BOOK STORAGE

PURPOSE: This worksheet provides you with lists of books, by activity areas, that have been used in Career Exploration (Occupational Versatility) shops. This list, of course, cannot be considered complete because it is impossible to know all texts and other printed materials that may be available and could be recommended for each activity. The lists, however do represent a place to start in making collections of useful material. You are encouraged to be on the lookout for new and promising books and publications that are announced by publishers and in professional journals.

WORKSHEET # 13.1

WOODS BOOK LIST

PURPOSE: This suggested book list covers a wide variety of different books related to woodworking. Check the columns to determine what books you will need.

COLOR CODING: Cut a strip of 1" colored contact paper and place over the back of each book. Use yellow for wood.

VENDOR I.D. #: 9, 12, 13, 25, 44, 46

BILL OF MATERIALS: Pencil in the information necessary to prepare for your book order.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	1	Bench Woodwork, Feirer, Hutchings Charles A. Bennett, Inc.			
	1	Contemporary Lamps, Holbrook McKnight & McKnight Co.			
	2	Exploring Woodworking, Zimmerman Goodheart & Willcox			
	2	General Woodworking, Groneman McGraw-Hill Book Co.			
		Getting the Most out of Your . . Band Saw Circular Saw Drill Press Lathe Scroll Saw/Jointer Deltacraft Publications			
		Practical Finishing Methods, Delta Publishing			
	2	Industrial Arts Woodworking, Feirer, Chas. A. Bennett, Inc.			
	1	Modern Carpentry, Wagner Goodheart & Willcox			
	1	Make Your Own Sports Gear, Spielman, Bruce Publishing			
	1	Projects in Wood Furniture, Douglas-Roberts, McKnight & McKnight			
	2	Woodworking, Wagner Goodheart-Willcox			
	1	Basic Woodworking Projects, McGinnus-Ruley, McKnight & McKnight			

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	1	Woodworking Technology, 1972 Hammond, Donnelly, Harrod, Ryner, McKnight & McKnight			
	1	Cabinetmaking, Feirer Charles A. Bennett, Inc.			
	1	Woodturning, E. Rebhorn 1970 McKnight & McKnight			
	1	Carpentry, Wagner Goodheart & Willcox			
	1	Art of Woodturning, Klenke Charles A. Bennett, Inc.			
	1	Woodturning Visualized, R. C. Cramlet, Bruce Publishing			
	1	Woodworking for Industry, Feirer, Chas. A. Bennett, Inc.			
	1	Operations of Modern Woodworking Machines, Hyorth-Hotrop Bruce Publishing Co.			

BOOK COST: Add up cost column and enter on Estimated Cost blank.

EST. COST ______________

TIME: To order and color code wood books (2 hours).

EST. TIME ______________

WORKSHEET # 13.2

METALS BOOK LIST

PURPOSE: This suggested list covers a wide variety of different books about metalworking. Check the columns to determine what books you will need.

COLOR CODING: Place a piece of 1" colored contact paper over the back of each book.

VENDOR I.D. #: 12, 17, 25, 44, 46

BILL OF MATERIAL: Pencil in the necessary information you need to prepare your book order.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	2	Exploring Metal Working, Walker, Goodheart-Willcox			
	1	General Metals, Feirer McGraw-Hill, 1967			
	1	Metal Work, Feirer, Lindbeck Chas. A. Bennett Co.			
	1	Modern Metal Working, J. Walker Goodheart & Willcox			
	1	Metal Working 2, Boyd Goodheart & Willcox			
	1	Practical Metal Projects 2, Ruley, McKnight & McKnight			
	1	Projects in General Metal Working 2, Ruley, McKnight & McKnight			
	1	Technical Metals, Johnson Chas. A. Bennett, Inc. 1973			
	2	Sheet Metal, R. Smith McKnight & McKnight			
	1	Modern General Shop, Borwn Wagner, Boyd, Gerrish Goodheart & Willcox			
	1	Metalwork-Technology & Practice, Ludwig, McCarthey			
	1	Turning Technology, Krar, Oswald, Delmar Publishing			
	1	Machine Tool Technology, McCarthy-Smith McKnight & McKnight Co.			

BOOK COST:

EST. COST______________

TIME: To order and color code (1 hour).

EST. TIME______________

WORKSHEET # 13.3

HOT METALS BOOK LIST

PROCEDURE: Check through this suggested book list and see if you will need to order more books to begin your Hot Metals program.

COLOR CODING: So that students can locate reference material, a small strip of colored contact paper is placed over the back of each book.

VENDOR I.D. #: 17, 25, 46

BILL OF MATERIAL: Using a current catalog, pencil in the publisher and cost.

ON HAND	NO REQ	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	2	Forging & Welding, Smith McKnight & McKnight			
	2	Heat Treatment of Metals Litton Ed., Delmar Pub.			
	1	Modern Welding, Bowditch Althouse & Tuinquist, Goodheart - Willcox			
	1	Welding Processes, Griffin-Roden, Delmar Pub.			
	1	Basic Arc Welding, Griffin-Roden, Delmar Pub.			
	1	Basic Oxy-acetylene Welding, Griffin & Roden, Delmar Pub.			
	1	Arc Welding, Walker Goodheart-Willcox			
	4	Welding, Cutting & Heating Guide, Victor Cutting & Welding Division			

BOOKS COST

EST. COST ____________

TIME: To order and color code (1 hour).

EST. TIME ____________

WORKSHEET # 13.4

PLASTICS BOOK LIST

PURPOSE: Instead of ordering a complete set of books, we suggest that you order a wide variety of different books. Check through the list and add to it if necessary.

COLOR CODING: A strip of colored contact paper is placed on the back of each book so students can find reference material. A different color of contact paper is used for each activity area.

VENDOR I.D. #: 12, 25, 44, 46

BILL OF MATERIAL: Pencil in the cost of each book using a current catalog.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	2	*Industrial Arts Plastics,* 1964 Edwards, Chas. A. Bennett Co.			
		Industrial Plastics 3, 1971 Baird, Goodheart & Willcox			
	2	*Plastics,* Cope & Conway 1966 Goodheart & Willcox			
	1	*Plastic Projects and Techniques,* Lappin McKnight & McKnight Co.			
		Plastics Technology, Swanson McKnight & McKnight Co, 1965			
		General Plastics, Cherry McKnight & McKnight 1967			
		Modern Plastics, McGraw-Hill Encyclopedia 1970-71			
		Fiber Glass, Projects & Procedures, Steele McKnight & McKnight Co.			

BOOK COST:

EST. COST ________________

TIME: To order and color code (1 hour)

EST. TIME ________________

WORKSHEET # 13.5

CRAFT BOOK LIST

PURPOSE: Since the Craft area covers a wide variety of different activities, just a few books have been suggested. Consider the activities you will include in your Craft area and add books to this list if necessary.

COLOR CODING: From colored contact paper, cut 1" strips and place over the back of each book.

VENDOR I.D. #: 9, 12, 25, 46, 58

BILL OF MATERIAL: Fill in the necessary information for your crafts book order.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	2	Artistic Metalwork, Bick Bruce Publishing			
	2	Basic Crafts, Lindbeck-Hansen Charles A. Bennett Co. 1969			
	2	Leathercraft (2), Groneman Charles A. Bennett Co.			
	2	General Leathercraft, Cherry McKnight & McKnight Co.			
	1	Ideas for Leather Belts You Can Make, A. Stohlman, Tandy Leather Co.			
	1	Leather Work, Stohlman, Patton, Wilson, Tandy Leather			
	2	Art Metals, Seigner Goodheart-Willcox			
	1	Essentials of Modern Upholstery, Bast, Bruce Publishing			
	1	Handwrought Jewelry, Franke McKnight & McKnight Co.			

BOOK COST:

EST. COST ________________

TIME: To order and color code (1 hour).

EST. TIME ________________

WORKSHEET # 13.6

POWER MECHANICS BOOK LIST

PURPOSE: This suggested book list will help you start your Power Mechanics activity area. You will need to add to this list as you expand the number of activities in your Power Mechanics area.

COLOR CODING: A 1" strip of colored contact paper is placed over the back of each book so that students can locate reference material easily.

VENDOR I.D. #: 8, 25, 27

BILL OF MATERIAL: Check appropriate columns and pencil in the necessary information.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	2	All About Small Gas Engines J Purvis, Goodheart-Willcox			
	1	Auto Mechanics Fundamental Stockel, Goodheart-Willcox			
	1	Automotive Encyclopedia Toboldt, Johnson Goodheart-Willcox			
	1	Power Mechanics Atteberry, Goodheart-Willcox			
	2	Small Gas Engines T. Pipe, Howard W. Sams & Co.			
	1	Auto Body Repairing & Repainting, B. Tobodbt, Goodheart & Willcox			
	2	General Theories of Operation Briggs & Stratton			
	2	Repair Instructions II Briggs & Stratton			
	2	Small Engines Service Manual Intertec Pub. Corp. 1969			

BOOK COST:

EST. COST ________________

TIME: To order and color code (1 hour)

EST. TIME ________________

WORKSHEET # 13.7

GRAPHICS BOOK LIST

PURPOSE: This is a suggested list to help you develop a graphics activity area. Check the appropriate columns to see what books you will need to order.

COLOR CODING: A 1" strip of colored contact paper is cut and placed over the back of each book.

VENDOR I.D. #: 12, 25, 46

BILL OF MATERIAL: Pencil in the necessary information.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLSIHER	TO ORDER	SUPPLIER	COST
	2	Graphic Arts, Carlsen Charles A. Bennett Co.			
	2	Silk Screen Printing, Eisenberg & Kafka McKnight & McKnight Co.			
	1	General Printing, Pitkin - Cornwell McKnight & McKnight Co 1963			
	1	Practical Photography, McCoy, 1972 McKnight & McKnight Co.			
	2	Graphic Arts, Kagy Goodheart - Willcox 1965			

BOOK COST:

EST. COST ____________

TIME: To order and color code graphic books (1 hour)

EST. TIME ____________

WORKSHEET # 13.8

GENERAL INDUSTRIES BOOK LIST

PURPOSE: Since the General Industries area covers a wide variety of different activities, just a few books have been suggested. Consider the activities you will include in your General Industry area and add to this list if necessary.

COLOR CODING: From colored contact paper, cut 1" strips and place over the back of each book.

VENDOR I.D. #: 12, 17, 25, 46, 57

BILL OF MATERIAL: Check the appropriate columns and pencil in the necessary information.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	1	Modern Carpentry, Wagner Goodheart & Willcox			
	1	Woodworking for Industry, Feirer, Charles A. Bennett, Inc.			
	1	House Wiring Simplified, Mix, Goodheart & Willcox			
	1	Home and Building Maintenance, Woodin, Hayes-McKnight & McKnight			
	1	Walks, Walls & Patio Floors, Sunset Lane Books			
	1	Bricklaying 1, Delmar			
	1	Bricklaying 11, Delmar			
	1	Concrete Technology, Delmar			

BOOK COST:

EST. COST ________________

TIME: To order and color code (1 hour).

EST. TIME ________________

WORKSHEET # 13.9

ELECTRICITY/ELECTRONICS BOOK LIST

PURPOSE: So that you will know about some of the books useful in this activity area, we are furnishing this suggested book list.

COLOR CODING: Cut a 1" strip of colored contact paper and place over the back of each book.

VENDOR I.D. #: 9, 25, 27, 46, 53

BILL OF MATERIAL: Refer to the publishers' catalogs and pencil in the supplier and cost in the spaces provided.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	1	All About Home Wiring, F. Mix Goodheart & Wilcox			
	1	Home Mechanics, Schaefer, Smith Bruce Publishers			
	2	Electronics 4, Gerrish Goodheart & Willcox			
	1	How to Repair Small Appliances, J. Darr, Howard W. Sams, Inc.			
	1	Projects in Electricity Collings, McKnight & McKnight			
	1	House Wiring Simplified, F. Mix Goodheart-Willcox			
	1	Simplified Electrical Wiring Sears Roebuck & Co.			
	2	Exploratory Electricity Arnold, Shank McKnight & McKnight			
	1	Exploring Electronics Gerrish, Goodheart-Willcox			

BOOK COST:

EST. COST ____________

TIME: To order and color code (1 hour).

EST. TIME ____________

WORKSHEET # 13.10

DRAFTING BOOK LIST

PURPOSE: To give you an idea of the type and amount of books to start a drafting area, this suggested list is furnished.

COLOR CODING: Cut a strip of 1" colored contact paper and place over the back of each book.

VENDOR I.D. #: 12, 17, 25, 46

BILL OF MATERIAL: Pencil in the necessary information to prepare for ordering the books you will require.

ON HAND	NO. REQ.	TITLE, AUTHOR, PUBLISHER	TO ORDER	SUPPLIER	COST
	1	Drawing & Planning for Industrial Arts, Feirer Chas. A. Bennett Inc. 1963			
	1	The World of Drafting, Ross McKnight & McKnight Co, 1971			
	2	Exploring Drafting, Walker Goodheart & Willcox, 1972			
	1	General Architectural Drawing, Wyatt, Chas. A. Bennett, Inc.			
	1	Drafting, W. Brown, Goodheart & Willcox			
	1	Drafting, Industrial Arts, Walker-Pleveyk Goodheart & Willcox			
	1	Drafting Technology, Horton, Rothaus, Delmar Publishing			

BOOK COST:

EST. COST ________________

TIME: To order and color code drafting books (1 hour).

EST. TIME ________________

WORKSHEET # 13.11

BOOK STORAGE

PURPOSE: So that students can easily locate and replace reference material, it is suggested that book racks be constructed and located in the planning areas or in each of the activity areas.

COLOR CODING: If you place the books in the activity areas, color code by painting the book storage rack the activity area color. If they are placed in the planning area, apply a wood stain finish.

VENDOR I.D. #: 36, 37

BILL OF MATERIAL: Design a book storage rack for each activity. Use the space below to figure material cost.

MATERIAL COST:

Number of Racks ________ @ Cost ________________ EST. COST ________________

TIME: To design, construct, finish and color code (2 holders per hour).

Number of Racks ________ ÷ __________ per hour EST. TIME ________________

WORKSHEET # 14

ODDS & ENDS

PURPOSE: The fact that the worksheets in this category are labeled "Odds and Ends" means that they do not fit logically in any of the other categories. It does not mean, however, that they are less important.

Worksheet 14.1 is for estimating time for miscellaneous activities. Worksheet 14.2 contains information about a career exploration workshop conducted by Oregon State University each summer for instructors.

WORKSHEET # 14.1

ESTIMATE TIME FOR MISCELLANEOUS ACTIVITIES

PURPOSE: There are many loose ends to be brought together before you can complete the planning of your new facility for Career Exploration in the Industrial Arts. Among those miscellaneous items could be:

- Ordering supplies
- Completing the finish area
- Developing additional self-instructional materials
- Remodeling, color-coding and otherwise completing one or more activity areas that, for some reason or other, had not been completed along with the other areas
- Planning the student orientation sessions
- Organizing the team-teaching by-laws and procedures
- Making another visit to a pilot program
- Developing additional reference material

ESTIMATED TIME: To allow yourself time to accomplish these yet-to-be determined miscellaneous activities, total the estimated times entered on Worksheet 15 and figure a percentage, based upon your own estimate, of this total time for completing these miscellaneous activities. (Experience in the pilot projects suggests that this might be about 5%.)

TOTAL ESTIMATED TIME:

From Worksheet 15____________ X__________ % = EST. TIME _________________

Enter Miscellaneous Time on Worksheet 15.

WORKSHEET # 14.2

CAREER EXPLORATION WORKSHOP

PURPOSE: So that you can gain some added information and understand your new teaching role, a workshop is scheduled to be taught each summer at Oregon State University. This graduate-level workshop is conducted under actual class conditions in a Career Exploration shop. Information and material developed by you in the workshop can be used in your own facility. For information about credits, cost, time, location and dates of class, contact:

OREGON STATE UNIVERSITY
INDUSTRIAL EDUCATION DEPARTMENT
CORVALLIS, OREGON 97331

WORKSHOP COST:

Cost of Graduate Class ____________________

Travel Expenses ____________________

Meals & Lodging ____________________

EST. COST ____________________

WORKSHEET # 15

COST SUMMARY SHEET

PURPOSE: Post in the appropriate column the estimated cost and time computed on each of the previous worksheets which you used to figure cost and time of any kind. Totaling of each column can give you estimated costs of each of the major activities involved in planning and establishing your facility.

FACILITY REMODELING:

Worksheet # 4	Est. Cost	Est. Time
4.1 Walls		
4.2 Electrical		
4.3 Sheet Metal		
4.4 Plumbing		
4.5 Heating		
4.6 Floors		
4.7 Ceiling		
4.8 Equipment		
4.9 General		
	COST	TIME(HOURS)

CASEWORK ORDER:

Worksheet # 5	Est. Cost	Est. Time
	COST	TIME(HOURS)

CASEWORK CONSTRUCTION:

Worksheet # 6	Est. Cost	Est. Time
6.1 8' Cabinet		
6.2 4' Cabinet w/ doors		
6.3 4' Cabinet w/ sliding door		
6.4 Corner Cab.		
6.5 Sm. Engine Storage		
	COST	TIME(HOURS)

EQUIPMENT ORDER:

Worksheet # 7	Est. Cost	Est. Time
7.1 Woods		
7.2 Metals		
7.3 Hot Metals		
7.4 Plastics		
7.5 Crafts		
7.6 Power		
7.7 Graphics		
7.8 Gen. Industries		
7.9 Elect/Electron.		
	COST	TIME(HOURS)

HAND TOOL ORDER:

Worksheet # 8	Est. Cost	Est. Time
8.1 Woods		
8.2 Metals		
8.3 Hot Metals		
8.4 Plastics		
8.5 Crafts		
8.6 Power Mechanics		
8.7 Graphics		
8.8 Gen. Industries		
8.9 Elect/Electron.		
8.10 Drafting		
	COST	TIME(HOURS)

COLOR CODING

Worksheet # 9	Est. Cost	Est. Time
	COST	TIME(HOURS)

MEDIA BOARDS:

Worksheet # 10	Est. Cost	Est. Time
10.1 Media Boards (Tool Panel) Holder		
10.2 Media Boards (Tool Panel)		
10.3 Hand Tool Color Coding		
10.4 Hand Tool Outline (Silhouettes)		
10.5 Mounting & layout of hand tools		
10.6 Hand Tool I.D.		
10.7 Small Tool Cab.		
10.8 Portable Tool Holder		
	COST	TIME(HOURS)

STUDENT MANAGEMENT SYSTEM:

Worksheet # 11	Est. Cost	Est. Time
11.1 Student Notebooks		
11.2 Attendance Record		
11.3 Student Performance Rec.		
11.4 Equip. Op. Check List		
11.5 Plan Sheet		
11.6 Material Cost Record		
11.7 Student Eval. Sheets		
11.8 Parent Permit Slip		
11.9 Student Orientation Sheets		
11.10 Notebook Rack		
11.11 Plug-In Box		
	COST	TIME(HOURS)

SELF-INSTRUCTIONAL SYSTEM:

Worksheet # 12	Est. Cost	Est. Time
12.1 Basic 10 Sel.		
12.2 Building Basic 10 Projects		
12.3 Mounting Basic Sheets		
12.4 Basic 10 Holder		
12.5 Basic 10 Project Holder		
12.6 Area Signs		
12.7 Price Lists		
12.8 Equip. Op. Notebooks		
12.9 Equip. Op. Sheets		
12.10 Equip. Op. Notebook Stor.		
12.11 Equip. Color Coding		
12.12 Equip. I.D.		
12.13 Single Concept Film Loop List		
12.14 Film Loop Rack		
12.15 Film Strip List		
12.16 Film Strip Rack		
12.17 A.V. Equipment		
	COST	TIME(HOURS)

BOOK ORDER & STORAGE

Worksheet # 13	Est. Cost	Est. Time
13.1 Woods		
13.2 Cold Metals		
13.3 Hot Metals		
13.4 Plastics		
13.5 Crafts		
13.6 Power Mechanics		
13.7 Graphics		
13.8 Gen. Industries		
13.9 Elect/Electron.		
13.10 Drafting		
13.11 Book Storage		
	COST	TIME(HOURS)

ODDS & ENDS

Worksheet # 14	Est. Cost	Est. Time
14.1 Misc. Items		
14.2 Career Exploration Workshop		
	COST	TIME(HOURS)

ITEM	WORKSHEET	COST	TIME(HRS)
Remodeling	4		
Casework	5		
Casework Construction	6		
Equipment Order	7		
Hand Tool Order	8		
Color Coding	9		
Media Boards	10		
Student Management	11		
Self-Instructional	12		
Book Order	13		
Odds & Ends	14		
		Material Cost	Total Hours

Total Hours ___ X Hr. Wage ___ = __________
Labor Cost

Material Cost + Labor Cost = Program Cost

WORKSHEET # 16

DEVELOP A TIME LINE

PURPOSE: This worksheet charts a hypothetical planning sequence that begins in October and ends the following August. The chart is on the reverse of this sheet. The activities to be accomplished are represented by the worksheets of this guide. The numbers appearing on the time line are those of the worksheets.

Worksheet 16.1 is a form that you may use to set up your own time line. Begin by inserting the months during which you anticipate accomplishing the planning and installation of your facility. Then enter the worksheets, by number, that need to be completed. Use Worksheet 16 for suggestions as to the sequence in which the worksheets are to be completed and the time to be alloted for completing them.

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.
ORDER EQUIPMENT, TOOLS, CASEWORK				#5, 8-8.10, 7-7.9							
ORDER MATERIAL	#4.1-4.9, 6.1-6.5, 10-10.8, 11.10, 11.11, 12.2-12.7, 12.10, 12.12, 12.14, 12.16, 13.11										
ORDER NOTEBOOKS & PAPER			#11.1-11.9, 12.8, 12.9								
SELECT BASIC 10'S			#12.1								
PREVIEW AND ORDER A.V. MATERIAL			#12.13, 12.15, 12.17								
BOOK ORDER			#13.1-13.10								
COLOR CODING ORDER						#9, 12.11					
REMODELING								#4.1-4.9			
CASEWORK CONSTRUCTION										#6.1-6.5	
INSTALL MEDIA BOARDS								#10-10.8			
MANAGEMENT SYSTEM									#11.1-11.11		
SELF-INSTRUCTIONAL SYSTEM									#12.2-12.17, 13.1-13.11		
SUMMER WORKSHOP & MISC.									#14.1, 14.2		

WORKSHEET # 16.1

TIME LINE

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.
ORDER EQUIPMENT. TOOLS, CASEWORK											
ORDER MATERIAL											
ORDER NOTEBOOKS & PAPER											
SELECT BASIC 10'S											
PREVIEW AND ORDER A.V. MATERIAL											
BOOK ORDER											
COLOR CODING ORDER											
REMODELING											
CASEWORK CONSTRUCTION											
INSTALL MEDIA BOARDS											
MANAGEMENT SYSTEM											
SELF INSTRUCTIONAL SYSTEM											
SUMMER WORKSHOP & MISC.											

APPENDIX A

CAREER EXPLORATION/INDUSTRIAL ARTS PROGRAM
(STUDENT MANAGED LEARNING)

GOALS FOR CAREER EXPLORATION

STUDENTS WILL:

GOAL NO.

1 MANAGE THEIR OWN SHOP ACTIVITIES.

2 SELECT AN INSTRUCTIONAL DEVICE AND/OR DEVELOP HIS OWN PROCEDURE FOR EACH PROJECT.

3 RECORD ACTIVITIES AND EVALUATE THEIR OWN PERFORMANCE FOR PROJECTS.

4 WORK IN AT LEAST 75% OF AVAILABLE AREAS (I.E., METALS, WOODS, PLASTICS, ETC.) DURING THE COURSE OF THE YEAR.*

5 RECOGNIZE THE NECESSITY OF PLANNING THEIR ACTIVITIES.

6 DEMONSTRATE A POSITIVE ATTITUDE TOWARD PLANNING THEIR ACTIVITIES.

7 DEMONSTRATE POSITIVE ATTITUDES TOWARD SELF-INSTRUCTION.

8 DEMONSTRATE LESS DEPENDENCE ON THE INSTRUCTOR.

*IMPLEMENTATION OF ALBANY CAREER EXPLORATION/INDUSTRIAL ARTS (STUDENT MANAGED LEARNING) PROGRAM NEED NOT BE CONFINED TO THE TECHNICAL CONTENT AREAS LISTED HEREIN. TECHNICAL CONTENT AREAS SHOULD BE SELECTED TO FIT THE STUDENT AND FACILITY NEEDS OF THE IMPLEMENTING SCHOOL.

OBJECTIVES

THE STUDENT WILL:

1.1 GIVEN APPROPRIATE FORMS, RECORD DAILY ATTENDANCE.

1.2 GIVEN APPROPRIATE FORMS, COMPUTE AND RECORD MATERIAL AND SUPPLY PURCHASES.

1.3 GIVEN APPROPRIATE GUIDELINES, EVALUATE SAFETY PRACTICES AND CLEANLINESS PERFORMANCE.

2.1 GIVEN APPROPRIATE INSTRUCTIONAL DEVICES, SELECT THOSE WHICH BEST ENABLE MASTERY OF SELECTED SKILLS AND KNOWLEDGES.

2.2 LIST THE STEPS NECESSARY FOR COMPLETING A SELECTED PROCESS.

2.3 GIVEN APPROPRIATE TOOLS AND EQUIPMENT, DEMONSTRATE THEIR SAFE USE.

2.4 GIVEN APPROPRIATE TOOLS AND EQUIPMENT, DEMONSTRATE THEIR PROPER USE.

2.5 DEVELOP A PROJECT PLAN CONTAINING A LISTING OF PROCEDURES.

2.6 COMPLETE A SELECTED PROJECT ACCORDING TO PLAN.

3.1 GIVEN A STUDENT PERFORMANCE FORM, RECORD ACTIVITIES COMPLETED.

3.2 GIVEN EVALUATIVE CRITERIA, COMPLETE A SELF-EVALUATION OF SELECTED PROJECTS.

4.1 GIVEN A SUFFICIENT NUMBER OF AREAS, PERFORM SELECTED ACTIVITIES IN AT LEAST 75% OF THE AREAS DURING THE COURSE OF THE YEAR.

4.2 PERFORM BASIC METALWORKING OPERATIONS.

4.2.1 DEMONSTRATE UNDERSTANDING OF AND THE ABILITY TO COMPLETE HOT METALWORKING OPERATIONS.

4.2.1.1 DEMONSTRATE THE CORRECT PROCEDURES WHEN WORKING WITH:

ARC WELDING
BRAZING
CUTTING
GAS WELDING
SOLDERING
SPOT WELDING

4.2.1.2 DEMONSTRATE PROPER FOUNDRY PROCEDURES FOR:

POURING
PATTERN MAKING
MOLDING
CORE MAKING
STYROFOAM CASTING
INVESTMENT CASTING

4.2.1.3 DEMONSTRATE PROPER PROCEDURES WHEN WORKING WITH:

FOUNDRY FURNACE
FORGE
SOLDERING FURNACE

4.2.2 DEMONSTRATE UNDERSTANDING OF AND THE ABILITY TO PERFORM COLD METALWORKING PROCESSES.

4.2.1.1 DEMONSTRATE CORRECT PROCEDURES WHEN PERFORMING BASIC SHEET METAL PROCESSES:

FORMING
BENDING
CUTTING
ETCHING
PATTERN LAYOUT
RIVETING
PEENING
ROLLING
SEAMING
SOLDERING
SPINNING

4.2.2.2 DEMONSTRATE THE CORRECT PROCEDURES WHEN PERFORMING THE PROCESSES OF:

COLD BENDING
CUTTING
DRILLING
FILING
HOT BENDING
RIVETING
TAP AND DIE THREADING
TWISTING

4.2.2.3 DEMONSTRATE CORRECT PROCEDURES WHEN OPERATING COLD METAL STATIONARY EQUIPMENT:

BENDER
DRILL PRESS
FORMING ROLLER
GRINDER
METAL LATHE
PAN BRAKE
POWER HACK SAW
SHEAR
WIRE WHEEL
SANDER/GRINDER

4.2.2.4 GIVEN APPROPRIATE INSTRUCTION AND RESOURCES, FINISH PROJECTS USING APPROPRIATE PROCEDURES.

4.3 DEMONSTRATE UNDERSTANDING OF AND ABILITY TO PERFORM BASIC OPERATIONS AND PROCESSES COMMON TO THE GRAPHIC COMMUNICATIONS FIELD.

4.3.1 DEMONSTRATE PROPER USE AND CARE OF BASIC TOOLS, INSTRUMENTS AND EQUIPMENT.

4.3.2 SELECT AN IDEA AND DESIGN A TRADEMARK, FAMILY CREST, ETC. TO REPRESENT IT.

4.3.3 ANALYZE PROOF SHEETS OF PHOTOS AND CROP TO IMPROVE QUALITY.

4.3.4 DEVELOP DESIGNS AND PASTE-UPS.

4.3.5 ILLUSTRATE PROPER USE OF DIMENSIONS AND TOLERANCING.

4.3.6 COMMUNICATE AN IDEA BY MAKING A THUMBNAIL, ROUGH AND FINISHED SKETCHES.

4.3.7 USING SYMBOLS, PREPARE A WORKING DRAWING WHICH CONFORMS TO ACCEPTED DRAWING STANDARDS.

4.3.8 DEMONSTRATE UNDERSTANDING OF DESIGN METHODOLOGY BY APPLYING BASIC PRINCIPLES TO THE SOLUTION OF SELECTED PROBLEMS.

4.3.9 DEMONSTRATE COMPETENCE IN PHOTOGRAPHY BY PROPERLY COMPLETING SELECTED ASSIGNMENTS.

4.3.10 SELECT AND USE A REPRODUCTION SYSTEM THAT BEST MEETS THE REQUIREMENTS OF A GIVEN JOB.

4.3.11 ASSEMBLE VISUAL MATERIALS, USING AT LEAST TWO DIFFERENT REPRODUCTION METHODS.

4.3.12 OPERATE AT LEAST TWO DIFFERENT PIECES OF REPRODUCTION EQUIPMENT IN A SAFE AND PROPER MANNER.

4.3.13 OPERATE A PRESS IN A SAFE AND PROPER MANNER.

4.3.14 APPLY SKETCHING AND MECHANICAL AIDS TO RENDER TECHNICAL ILLUSTRATIONS.

4.3.15 SKETCH AND IDENTIFY ISOMETRIC, OBLIQUE, ORTHOGRAPHIC AND GEOMETRIC CONSTRUCTIONS.

4.3.16 DEMONSTRATE KNOWLEDGE OF THE PRINCIPLES OF ORTHOGRAPHIC PROJECTION, SKETCHING, SECTIONING, AND WORKING DRAWINGS.

4.4 DEMONSTRATE UNDERSTANDING OF AND PERFORM BASIC OPERATIONS AND PROCEDURES COMMON TO THE FIELD OF INDUSTRIAL MECHANICS.

4.4.1 DEMONSTRATE THE PROPER CARE AND USE OF BASIC HAND AND POWER TOOLS.

4.4.2 IDENTIFY EACH OF THE THREE TYPES OF LEVERS.

4.4.3 DEMONSTRATE HOW EACH OF THE THREE LEVERS IS USED TO GAIN MECHANICAL ADVANTAGE.

4.4.4 IDENTIFY THE WHEEL, AXLE, PULLEY, INCLINED PLANE, SCREW, AND THE WEDGE AS FOUND IN SIMPLE MACHINES.

4.4.5 DEMONSTRATE HOW MECHANICAL ADVANTAGE IS GAINED IN EACH TYPE OF SIMPLE MACHINE.

4.4.6 DEMONSTRATE AN UNDERSTANDING OF AND THE ABILITY TO APPLY THESE SIMPLE MACHINES TO THE MORE COMPLEX MACHINES OF TODAY.

4.4.7 DEMONSTRATE THE ABILITY TO PERFORM BASIC SERVICE OPERATIONS ON BOTH TWO- AND FOUR-STROKE ENGINES.

4.4.8 DEMONSTRATE THE ABILITY TO INCREASE SPEED AND DECREASE TORQUE (OR DECREASE SPEED AND INCREASE TORQUE) BY EITHER CHANGING THE SIZE OF PULLEYS OR CHAIN SPROCKETS.

4.4.9 GIVEN FOUR BASIC TYPES OF GEARS, IDENTIFY THE SPUR, HELICAL, WORM, AND BEVEL.

4.4.10 DEMONSTRATE THE ABILITY TO INCREASE SPEED AND DECREASE POWER OR DECREASE SPEED AND INCREASE POWER BY CHANGING THE SIZES OF THE GEARS ON AN INPUT OR OUTPUT SHAFT.

4.4.11 RECOGNIZE THE BASIC COMPONENTS OF MECHANICAL SYSTEMS AS THEY RELATE TO THIS COURSE.

4.4.12 DEMONSTRATE THE ABILITY TO CONNECT BASIC COMPONENTS INTO A MECHANICAL SYSTEM.

4.4.13 RECOGNIZE THE BASIC COMPONENTS OF THE HYDRAULIC SYSTEM.

4.4.14 DEMONSTRATE THE ABILITY TO CONNECT BASIC COMPONENTS INTO A HYDRAULIC SYSTEM.

4.4.15 RECOGNIZE THE BASIC COMPONENTS OF A FLUID POWER SYSTEM.

4.4.16 CONNECT BASIC COMPONENTS INTO A GIVEN FLUID POWER SYSTEM.

4.4.17 CONNECT BASIC COMPONENTS INTO A FLUID-MECHANICAL SYSTEM THAT WILL AUTOMATICALLY CONTROL THE MOTION IN A SYSTEM.

4.4.18 ASSEMBLE AN ELECTRIC MOTOR DRIVEN SYSTEM THAT CAN BE SHIFTED IN AND OUT OF OPERATION THROUGH THE USE OF FLUID CONTROLS.

4.4.19 DEMONSTRATE THE ABILITY TO PERFORM BASIC MAINTENANCE PROCEDURES ON SELECTED MACHINES.

4.5 DEMONSTRATE THE ABILITY TO PERFORM BASIC OPERATIONS COMMON TO THE WOOD/FOREST PRODUCTS INDUSTRY.

4.5.1 DEMONSTRATE THE ABILITY TO PERFORM BASIC HAND WOODWORKING PROCEDURES IN A SAFE AND PROPER MANNER.

4.5.1.1 DEMONSTRATE CORRECT HAND SANDING PROCEDURES.

4.5.1.2 DEMONSTRATE PROPER USE OF HAND SCRAPING TOOLS.

4.5.1.3 DEMONSTRATE PROPER USE OF WOOD FILES.

4.5.1.4 DEMONSTRATE CORRECT HAND PLANE PROCEDURES WHEN SURFACING WOODS.

4.5.1.5 CUT WOOD TO SPECIFICATIONS USING HAND SAWS.

4.5.1.6 SHAPE AND REMOVE MATERIAL TO SPECIFICATION USING CARVING TOOLS.

4.5.1.7 DRILL HOLES TO SPECIFICATION USING HAND DRILLS.

4.5.1.8 JOIN MATERIALS TOGETHER USING PROPER JOINTS AND PROCESSES.

4.5.2 DEMONSTRATE THE ABILITY TO PERFORM BASIC MACHINE WOODWORKING PROCEDURES IN A SAFE AND PROPER MANNER.

4.5.2.1 CUT MATERIAL TO SPECIFIED SIZE USING THE BAND SAW.

4.5.2.2 DEMONSTRATE ABILITY TO DRILL HOLES TO SPECIFICATION USING A POWER DRILL.

4.5.2.3 DEMONSTRATE ABILITY TO DRILL HOLES TO SIZE USING A DRILL PRESS.

4.5.2.4 CUT MATERIAL TO DIMENSION USING THE TABLE, CIRCULAR, RADIAL ARM, SCROLL, AND SABER SAWS.

4.5.2.5 DEMONSTRATE THE ABILITY TO OPERATE THE JOINTER.

4.5.2.6 TURN MATERIAL TO TOLERENCES USING THE WOOD LATHE.

4.5.2.7 DEMONSTRATE THE ABILITY TO REMOVE MATERIAL USING THE BELT, DISC, AND VIBRATING SANDER.

4.5.2.8 DEMONSTRATE THE ABILITY TO REMOVE MATERIAL USING THE UNIPLANE.

4.5.2.9 REMOVE MATERIAL USING THE SANDER/GRINDER.

4.5.2.10 APPLY APPROPRIATE FINISHES TO SELECTED PROJECTS.

4.6 DEMONSTRATE THE ABILITY TO PERFORM BASIC OPERATIONS AND PROCEDURES COMMON TO THE FIELD OF ELECTRICITY/ELECTRONICS.

4.6.1 DEMONSTRATE UNDERSTANDING OF THE BASIC FUNDAMENTALS OF ELECTRICITY.

4.6.1.1 DEMONSTRATE CORRECT SAFETY PROCEDURES.

4.6.1.2 DISTINGUISH BETWEEN VARIOUS WIRE GAUGES.

4.6.1.3 IDENTIFY COMMON ELECTRICAL COMPONENTS.

4.6.1.4 COMPUTE RESISTANCE GIVEN CURRENT AND VOLTAGE.

4.6.1.5 COMPUTE CURRENT, GIVEN RESISTANCE AND VOLTAGE.

4.6.1.6 COMPUTE VOLTAGE, GIVEN RESISTANCE AND CURRENT.

4.6.1.7 DEFINE VOLTAGE, CURRENT, AND RESISTANCE AND STATE THEIR RELATIONSHIPS.

4.6.1.8 DESCRIBE THE DIFFERENCE BETWEEN AN AC AND DC VOLTAGE AND STATE A SOURCE FOR EACH.

4.6.1.9 SOLVE FOR VOLTAGE DROPS AROUND A CLOSED CIRCUIT WITH A GIVEN SOURCE VOLTAGE.

4.6.1.10 SOLVE FOR POWER CONSUMED IN A SERIES CIRCUIT.

4.6.1.11 IDENTIFY AND DESCRIBE BASIC ELECTRICAL SYMBOLS.

4.6.2 DEMONSTRATE THE ABILITY TO APPLY BASIC ELECTRICAL FUNDAMENTALS TO PRACTICAL PROBLEMS.

4.6.2.1 DEMONSTRATE THE ABILITY TO USE BASIC ELECTRICAL HAND TOOLS IN A SAFE AND EFFECTIVE MANNER.

4.6.2.2 GIVEN ELECTRICAL COMPONENTS, SOLDER THEM IN AN ACCEPTABLE MANNER USING A SOLDERING GUN.

4.6.2.3 GIVEN ELECTRICAL SCHEMATICS, CONSTRUCT BASIC CIRCUITS AS DIRECTED.

4.6.2.4 CONNECT A VTVM AND/OR VOM INTO A CIRCUIT AND RECORD THE MEASUREMENTS.

4.6.2.5 GIVEN A POWER SUPPLY, APPLY VARYING OUTPUTS TO SELECTED LABORATORY PROBLEMS.

4.6.2.6 GIVEN DIFFERENT TRANSISTORS, DETERMINE THE TYPES WITH AN OHM METER.

4.6.2.7 GIVEN A SCHEMATIC, ASSEMBLE A FORWARD BIASED TRANSISTOR CIRCUIT.

4.6.2.8 GIVEN APPROPRIATE COMPONENTS, RECTIFY AN AC VOLTAGE.

4.6.2.9 GIVEN APPROPRIATE COMPONENTS, REMOVE RIPPLE FROM A RECTIFIED AC VOLTAGE.

4.7 DEMONSTRATE THE ABILITY TO PERFORM BASIC PLASTICS FORMING, ASSEMBLY, AND FINISHING OPERATIONS.

4.7.1 DEMONSTRATE THE ABILITY TO PERFORM BASIC PLASTIC PROCESSES.

4.7.1.1 PERFORM INJECTION MOLDING OPERATIONS.

4.7.1.2 PERFORM BLOW MOLDING OPERATIONS.

4.7.1.3 PERFORM EXPANDABLE POLYSTYRENE OPERATIONS.

4.7.1.4 PERFORM COMPRESSION MOLDING OPERATIONS.

4.7.1.5 PERFORM VACUUM FORMING OPERATIONS.

4.7.1.6 PERFORM PLASTISOL MOLDING OPERATIONS.

4.7.1.7 PERFORM POWDER MOLDING OPERATIONS.

4.7.1.8 PERFORM FOAM MOLDING OPERATIONS.

4.7.1.9 DEMONSTRATE PROPER PLASTICS CASTING PROCEDURES.

4.7.1.10 PERFORM PLASTICS CEMENTING OPERATIONS.

4.7.1.11 WELD PLASTIC MATERIALS TOGETHER USING PROPER OPERATIONS.

4.7.1.12 CUT AND MACHINE PLASTICS MATERIALS TO SPECIFICATIONS.

4.7.1.13 DEMONSTRATE UNDERSTANDING OF THE METAL COATING PROCESS.

4.7.1.14 DECORATE PLASTICS THROUGH THE HOT STAMPING PROCESS.

4.7.1.15 DECORATE PLASTICS THROUGH THE SCREEN PRINTING PROCESS.

4.7.1.16 PERFORM ENGRAVING OPERATIONS ON PLASTIC MATERIALS.

4.7.1.17 POLISH PLASTICS MATERIALS TO SPECIFICATIONS.

4.7.1.18 LAMINATE FIBERGLASS TO SPECIFICATIONS.

4.7.1.19 LAYUP LAMINATED FIBERGLASS TO SPECIFICATIONS.

4.7.2 DEMONSTRATE THE ABILITY TO OPERATE PLASTICS EQUIPMENT.

4.7.2.1 OPERATE A HEAT GUN SAFELY AND PROPERLY.

4.7.2.2 OPERATE A CHOPPER SAFELY AND EFFICIENTLY.

4.7.2.3 OPERATE A GEL COAT SPRAY GUN.

4.8 DEMONSTRATE THE ABILITY TO PERFORM BASIC CRAFT OPERATIONS.

4.8.1 DEMONSTRATE THE ABILITY TO CORRECTLY PERFORM BASIC PROCESSES WHEN WORKING WITH:

LEATHER STAMPING
LEATHER TOOLING
COPPER ENAMELING
FOIL TOOLING
WOOD CARVING
DYING
ROCK CUTTING
ROCK POLISHING
ROCK GRINDING
FLY TYING
MARQUETRY
DECOPAGUE

4.9 DEMONSTRATE AN UNDERSTANDING OF AND THE ABILITY TO APPLY BASIC GENERAL INDUSTRIAL PRACTICES AND PROCEDURES.

4.9.1 GIVEN APPROPRIATE RESOURCES, CAST MATERIALS TO SPECIFICATIONS.

4.9.2 GIVEN TOOLS AND MATERIALS, CUT AND PLACE TILE AS SPECIFIED.

4.9.3 GIVEN PLANS, CUT RAFTERS TO SPECIFICATIONS.

4.9.4 GIVEN BLUEPRINTS, FRAME A WALL TO SPECIFICATIONS.

4.9.5 GIVEN A PROBLEM, LAY BRICK AND STONE TO SPECIFICATIONS.

4.9.6 GIVEN INSTRUCTIONS, MIX CONCRETE TO SPECIFICATIONS.

4.9.7 GIVEN INSTRUCTIONS, MIX MORTAR AS DIRECTED.

4.9.8 GIVEN A PROBLEM, PERFORM BASIC PLUMBING OPERATIONS AS DIRECTED.

4.9.9 GIVEN INSTRUCTIONS, APPLY ROOFING MATERIALS AS DIRECTED.

4.9.10 GIVEN PLANS, CUT AND SET GLASS AS DIRECTED.

4.9.11 GIVEN PLANS, APPLY DRYWALL IN THE PRESCRIBED MANNER.

4.9.12 GIVEN A SET OF HOUSEPLANS, ASSEMBLE A MODEL TO SCALE.

4.9.13 GIVEN A PROBLEM, ENGAGE IN A MASS PRODUCTION EFFORT.

4.9.14 GIVEN BLUEPRINTS, CONSTRUCT A HALF-SCALE CORNER CONSTRUCTION.

4.9.15 GIVEN BLUEPRINTS, CONSTRUCT A FULL-SCALE CORNER CONSTRUCTION.

4.9.16 GIVEN BLUEPRINTS, CONSTRUCT A STRUCTURE TO SPECIFICATIONS.

5.1 GIVEN APPROPRIATE GUIDELINES, DEVELOP A PLAN FOR THEIR ACTIVITIES.

6.1 GIVEN AN "ATTITUDE TOWARD PLANNING INSTRUMENT", EXHIBIT A SIGNIFICANT INCREASE IN POSITIVE ATTITUDE TOWARD PLANNING ACTIVITIES.

7.1 GIVEN AN "ATTITUDE TOWARD SELF-INSTRUCTION INSTRUMENT", EXHIBIT A SIGNIFICANTLY MORE POSITIVE ATTITUDE TOWARD SELF-INSTRUCTION.

8.1 GIVEN AN "INSTRUCTOR DEPENDENCE ASSESSMENT INSTRUMENT", EXHIBIT A SIGNIFICANT DECREASE IN DEPENDENCE ON THE INSTRUCTOR.

THE BASIC 10'S

INCLUDED IN THIS APPENDIX TO THE GUIDE ARE COLLECTIONS OF PLAN SHEETS FOR BASIC 10'S IN EACH OF THE ACTIVITY AREAS. THE BASIC 10'S ARE DISCUSSED ON PAGE 52 OF THE GUIDE, AND SUGGESTIONS FOR BUILDING AND DISPLAYING BASIC 10'S ARE PRESENT IN WORKSHEET SERIES 12. TO COMPLETE THE BASIC 10 PLAN SHEETS, FILL IN THE REFERENCE SECTION WITH THE MEDIA FROM YOUR FACILITY. XEROX THE BASIC 10 SHEETS FROM THIS SECTION ON A DIFFERENT COLORED PAPER FOR EACH ACTIVITY AREA AS FOLLOWS:

PAGES	AREA	PAPER COLOR
B-2 - B-16	WOODS	YELLOW
B-17 - B-28	COLD METALS	BLUE
B-29 - B-40	HOT METALS	RED
B-41 - B-52	PLASTICS	PINK
B-53 - B-66	CRAFTS	PURPLE
B-67 - B-83	POWER	ORANGE
B-84 - B-95	GRAPHICS	GREEN
B-96 - B-114	GENERAL IND.	GRAY
B-115- B-126	ELECTRICITY/ ELECTRONICS	WHITE

TITLE: LIGHT ORGAN CABINET

COST: ________

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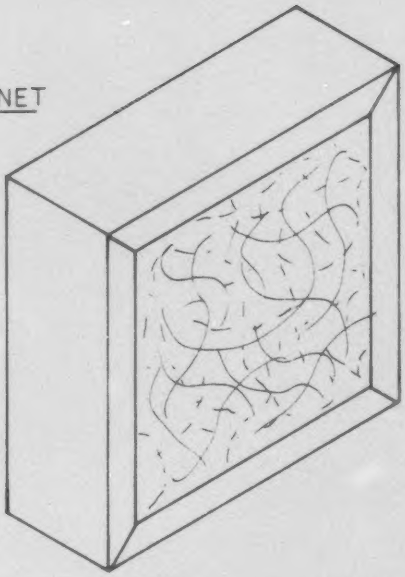


MATERIAL:

4 PCS. 1/8" X 1" X 12" MAHOGANY

4 PCS. 3/4" X 6" X 12" PINE

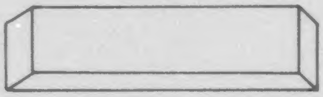
1 PC. 1/8" X 11 1/4" X 11 1/4" ACRILIC

1 PC. 1/8" X 11 1/4" X 11 1/4" TEMP. HARD BOARD

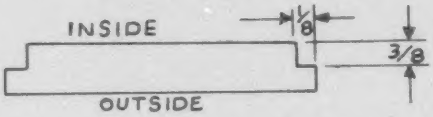
TOOLS & EQUIPMENT: TABLE SAW, DRILL PRESS, RULE, COMBINATION SQUARE, ORBITAL SANDER

PROCEDURES:	REFERENCES:

1. CUT 4 PIECES OF PINE WITH A 45 DEGREE MITRE ON EACH END. THESE PIECES ARE THE CABINET SIDES.



2. MAKE A RABBET CUT 1/8" DEEP X 3/8" WIDE. THE INSIDE EDGES OF ALL FOUR SIDES.

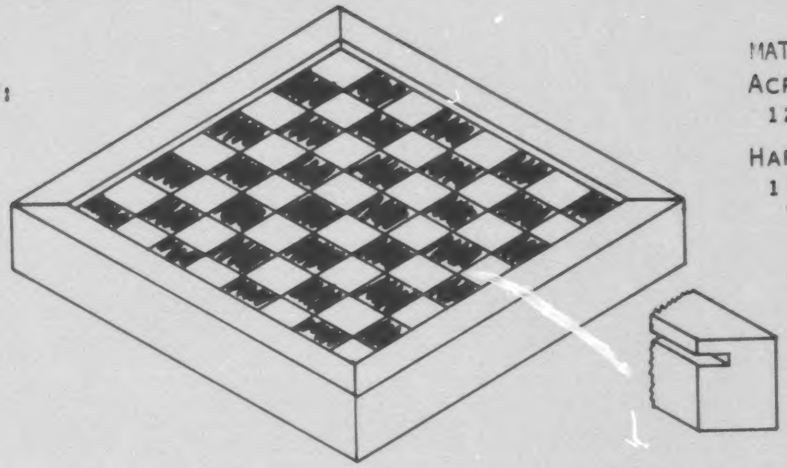


3. GLUE AND CLAMP ALL FOUR MITRE JOINTS TOGETHER.
4. AFTER GLUE IS DRY, REMOVE CLAMPS AND SAND CABINET SMOOTH.
5. CUT A 45 DEGREE MITRE ON THE END OF EACH PIECE OF MAHOGANY. THESE PIECES WILL FORM A FRAME TO HOLD THE ACRYLIC PANEL IN PLACE.
6. APPLY STAIN FINISH TO WOOD PARTS.
7. INSTALL ACRYLIC PANEL IN FRONT RABBET. SECURE IN PLACE BY FASTENING SMALL FRAME TO SIDES WITH BRADS.
8. INSTALL HARD BOARD IN BACK OF CABINET TEMPORARILY. THIS BOARD WILL HOLD THE LIGHTS AND ELECTRONIC COMPONENTS WHEN NEXT PHASE OF PROJECT IS COMPLETED.

TITLE: PLASTIC AND WOOD CHESS/CHECKER SET

COST: ____________

SKETCH:



MATERIAL:
ACRYLIC PLASTIC, 1/8" X 12" X 12"
HARDWOOD, 4 PIECES 1" X 2" X 12"

TOOLS & EQUIPMENT: TABLE SAW, UTILITY KNIFE, FRAMING SQUARE

PROCEDURES:

REFERENCES:

1. FROM 12" X 12" X 1/8" ACRYLIC PLASTIC, CUT TO 10 1/2" X 10 1/2" SQUARE.

2. IF PLASTIC HAS PAPER ALREADY ON IT, DO NOT REMOVE, AND PROCEED TO STEP #5. IF PLASTIC DOES NOT HAVE PAPER ON IT, CUT OUT SOME BUTCHER PAPER A LITTLE LARGER THAN PLASTIC AND APPLY RUBBER TO BOTH ONE SIDE OF PAPER AND ONE SIDE OF PLASTIC.

3. WHEN CEMENT IS DRY, PRESS THE TWO PIECES TOGETHER.

4. TRIM OFF THE EXCESS PAPER.

5. MARK OFF A 1/4" BORDER.

6. DIVIDE THE REMAINING AREA INTO 1 1/4" SQUARES.

7. CUT THE BACKING PAPER ON THE LINES WITH UTILITY KNIFE AND STEEL SQUARE AND THEN PEEL OFF ALTERNATING SQUARES.

8. PAINT PLASTIC WHERE PAPER WAS PEELED OFF WITH BLACK OR RED SPRAY AND LET DRY.

9. REMOVE THE REMAINING BACKING PAPER.

10. PROCESS WOOD TO GIVE DIMENSIONS.

11. CUT 1/8" GROOVE, 1/4" DEEP LENGTHWISE ON INSIDE OF HARDWOOD 1/4" FROM TOP.

12. MITRE THE ENDS OF HARDWOOD PIECES AT 45.

13. FIT HARDWOOD TOGETHER WITH ACRYLIC FITTED INTO GROOVE. (PAINTED SIDE DOWN.)

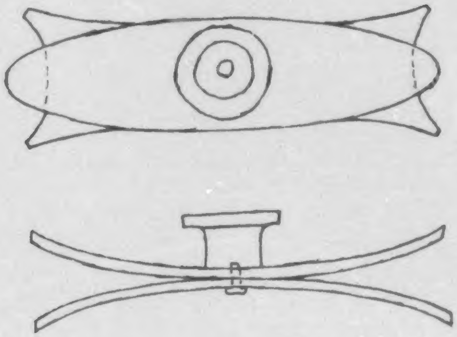
14. GLUE HARDWOOD TOGETHER (WHITE GLUE) WITH ACRYLIC FITTED INTO THE GROOVE (PAINTED SIDE DOWN).

15. HARDWOOD MAY BE OILED AT THIS POINT.

TITLE: LAMINATED CANDLE HOLDER

COST: ____________

SKETCH:



MATERIAL:

14 1/28" THICK VENEER 3" X 6"

1 KOSY CREATION CANDLE CUP

2 PCS. GARNET PAPER

WHITE GLUE

1 - 3/4" LONG 6 - 32 MACHINE SCREW & NUT

TOOLS & EQUIPMENT: LAMINATING JIG FORM, METAL TEMPLATES, SARAN WRAP (OR SIMILAR PLASTIC), BANDSAW, GLUE CLAMPS, DRILL PRESS, 1/8" DRILL BIT, DISC SANDER, SCREWDRIVER

PROCEDURES:

1. OBTAIN 7 PIECES OF VENEER (SIZE STATED).
2. SMEAR GLUE ON ALL BUT OUTER FACES.
3. PROTECT OUTER FACES WITH SARAN WRAP.
4. PLACE IN JIG FORM FOR GLUING.
5. CLAMP TIGHTLY WITH GLUE CLAMPS. CAUTION: MAKE SURE VENEERS SLIP EVENLY FROM CENTER OF CURVE.
6. LET AIR DRY IN CLAMPED FORM FOR 8 HOURS.
7. REMOVE FROM CLAMPED FORM.
8. SMOOTH ONE EDGE OF VENEER LAMINATION AGAINST DISC SANDER.
9. SAW SECOND EDGE PARALLEL ON BANDSAW 2 1/2" WIDE.
10. REPEAT STEPS 1-9 WITH REMAINING SEVEN PIECES.
11. TRACE TOP TEMPLATE PATTERN ON 1 LAMINATION.
12. TRACE BOTTOM TEMPLATE PATTERN ON OTHER LAMINATION.
13. FORM TOP LAMINATION CONVEX CURVE WITH DISC SANDER.
14. FORM BOTTOM LAMINATION CONCAVE CURVE WITH DRUM SANDER.
15. PREPARE LAMINATIONS WITH ABRASIVE PAPER.
16. MARK CENTER OF EACH LAMINATION FOR 1/8" HOLE.

REFERENCES:

LAMINATED CANDLE HOLDER (CON'T)

17. DRILL EACH LAMINATION AND BASE OF KOSY CUP.

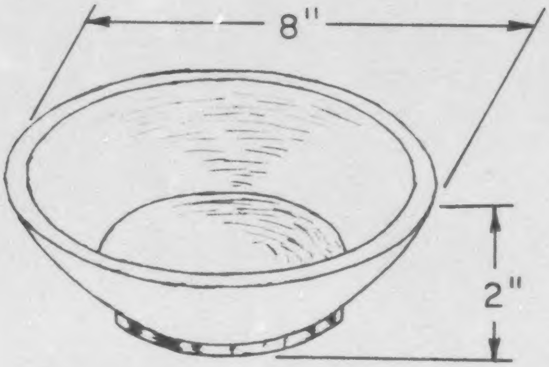
18. DANISH OIL LAMINATIONS. SPRAY PAINT KOSY CUP.

19. FASTEN LAMINATIONS AND KOSY CUP TOGETHER WITH MACHINE SCREW AND NUT.

TITLE: BOWL

COST: ____________

SKETCH:



MATERIAL:
2" HARDWOOD STOCK
8" SQUARE 3/4" X 8" X 8" PLYWOOD
8 - 1 1/4" NO. 10 WOODSCREWS

TOOLS & EQUIPMENT: LATHE, BANDSAW, GLUE CLAMPS, SCREWDRIVER, COMPASS

PROCEDURES:

1. SELECT KIND OF WOOD YOU DESIRE.
2. CUT TO APPROXIMATE SIZE WITH HANDSAW.
3. IF GLUING IS NECESSARY TO GET WIDTH, DO SO AFTER MAKING SURE EDGES ARE SQUARE.
4. CUT 3/4" FIR PLYWOOD 8" X8". USE BANDSAW OR HANDSAW.
5. CUT 8" X 8" PIECE OF BUTCHER PAPER.
6. MAKE SURE THE BOTTOM SIDE OF BOWL BLANK IS STRAIGHT.
7. USING WHITE VINYL GLUE, GLUE BUTCHER PAPER TO THE BOTTOM SIDE OF BOWL BLANK. PUT GLUE ON EVEN. PUT GLUE ON TOP OF BUTCHER PAPER AND ON ONE SIDE OF 3/4" PLYWOOD. PUT GLUED SIDES TOGETHER AND CLAMP ALL PARTS FIRMLY WITH 4 HANDSCREW CLAMPS.
8. REMOVE CLAMPS AFTER GLUE DRIES AND MARK CENTER OF SQUARE PLYWOOD.
9. DRAW CIRCLE ON BLANK AND CUT OUT ON BANDSAW.
10. CENTER AND MOUNT FACE PLATE WITH 8 - 1 1/4" NO. WOODSCREWS.
11. PUT ON LATHE.
12. USE ROUND NOSE CHISEL AND SHAPE TO DESIRED SHAPE. KEEP LATHE SPEED SLOW AT FIRST AND NEVER OVER 1000 RPM WHEN BOWL IS ROUND.

REFERENCES:

BOWL (CON'T)

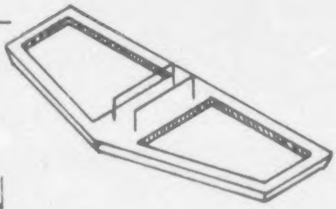
13. FINISH WITH DANISH OIL.

14. REMOVE FACEPLATE. REMOVE PLYWOOD WITH WOOD CHISEL.

15. FELT MAY BE CUT AND GLUED TO BOTTOM.

TITLE: DRESSER CADDY

COST: ______



MATERIAL: MAHOGANY OR WALNUT

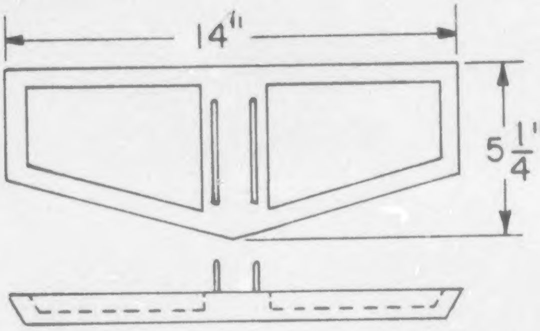
3/4" X 5 1/4" X 14" HARDWOOD

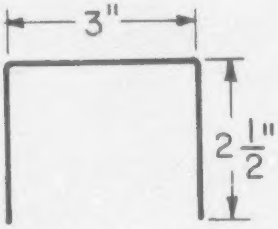
2 PCS. 1/8" X 8" BRAZING ROD

2 PCS. CORK OR FELT, 4" X 5 3/8"

1 PC. CORK OR FELT 5" X 12"

SKETCH:





TOOLS & EQUIPMENT: BANDSAW, RULER, ROUTER, SANDER, DRILL PRESS, SIDECUTTERS, MALLET, CORE BIT #85116 OR USE STANLEY 712 CUTTER, AND GRIND OFF RUNNER. JIGS ARE DESIGNED FOR ROUTERS WITH 5 1/4" OR 6" DIA. GUIDES.

PROCEDURES:

REFERENCES:

1. TRACE PATTERN ON SUITABLE MATERIAL.
2. CUT AND SAND TO PATTERN LINE. BANDSAW - SANDER.
3. PREPARE FACE SURFACE BY SANDING.
4. SELECT PROPER JIG FOR YOUR ROUTER.
5. INSTALL IN RIGHT OR LEFT JIG AND ROUTE MATERIAL.
6. SET ROUTER BIT TO CUT 3/8" DEEP.
7. ROUTE OUT MATERIAL.
8. INSTALL IN OTHER JIG AND ROUTE MATERIAL.
9. REMOVE FROM JIG AND PARE BOTTOMS WITH CHISEL.
10. MARK EDGES AT APPROXIMATELY 1/8" AROUND PROJECT.
11. CUT EDGES TO 30 DEGREES ANGLE TO FORM CHAMBER LEAVING ABOUT 1/8" SQUARE AT TOP TO PREVENT SHARP EDGE. BANDSAW - SANDER.
12. FINISH SAND PROJECT.
13. CUT FELT OR CORK TO FIT BOTTOM OF ROUTED AREA AND BOTTOM OF PROJECT. USE PATTERNS.
14. MEASURE AND DRILL 1/8" HOLES 1/2" DEEP IN CENTER OF PROJECT, LOCATE FROM PATTERN.
15. CUT 1/8" BRAZING ROD TO 8" LONG AND BEND TO PROPER SIZE.

DRESSER CADDY (CON'T)

16. PUT 2 3/4" IN VISE AND BEND AT RIGHT ANGLE. DO EACH END.

17. APPLY OIL FINISH.

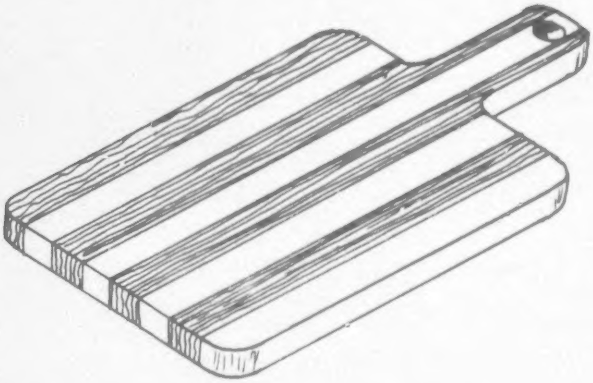
18. CEMENT FELT IN PLACE. CONTACT CEMENT OR WHITE GLUE.

19. INSTALL BRASS ROD.

TITLE: CUTTING BOARD LAMINATION

COST: ________

SKETCH:



MATERIAL:
1" THICK SHORT STOCK HARDWOOD, APPROX. 10" LONG
LEATHER STRAP
WATER REPELLANT GLUE
VEGETABLE OIL
ABRASIVE PAPER

TOOLS & EQUIPMENT: CIRCULAR SAW, SANDER, DRILL PRESS, SCROLL SAW OR BAND SAW, BAR CLAMPS, GLUE SCRAPER, CABINET SCRAPER

PROCEDURES:

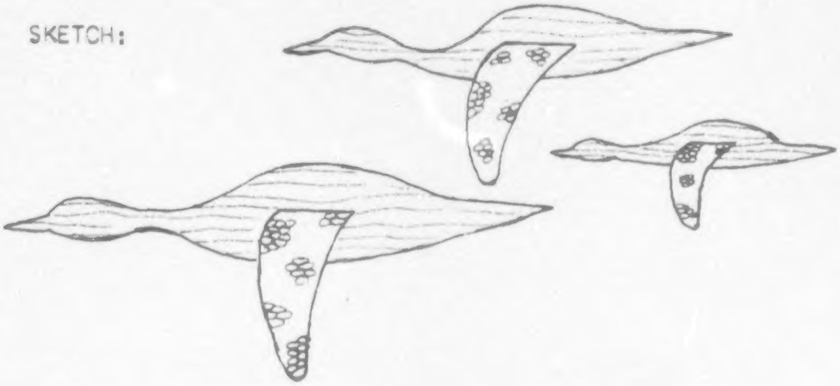
REFERENCES:

1. SELECT MATERIAL. LAY PIECES OF WOOD SIDE BY SIDE AND ARRANGE PIECES TO SUIT YOURSELF.
2. CUT PIECES TO WIDTH ON CIRCULAR SAW. ANY WIDTHS AND COMBINATIONS OF SIZES MAY BE USED. CUT ENOUGH SO A PIECE OF WOOD APPROXIMATELY 8" WIDE WILL RESULT WHEN PIECES ARE GLUED TOGETHER.
3. EDGE GLUE PIECES TOGETHER IN DESIRED PATTERN. LET DRY OVERNIGHT.
4. SCRAPE OFF EXCESS GLUE WITH GLUE SCRAPER.
5. USE HAND PLANE, CABINET SCRAPER, AND SANDER TO ROUGHLY FINISH BOTH SIDES.
6. DRAW SHAPE OF CUTTING BOARD ON YOUR PIECE OF WOOD.
7. CUT TO LINE ON BANDSAW OR SCROLL SAW.
8. DRILL 1/2" HOLE IN HANDLE ON DRILL PRESS.
9. DO ALL FINISH SANDING ROUNDING EDGES AS DESIRED.
10. APPLY VEGETABLE OIL FOR FINISH.
11. ATTACH PIECE OF LEATHER AS DESIRED TO HANDLE.

TITLE: DUCK SET

COST: ______

SKETCH:



MATERIAL:
1 PC. WESTERN RED CEDAR
1/2" X 6" X18"

3/4" NAILS

1 PC. .013 6" X 6" BRASS

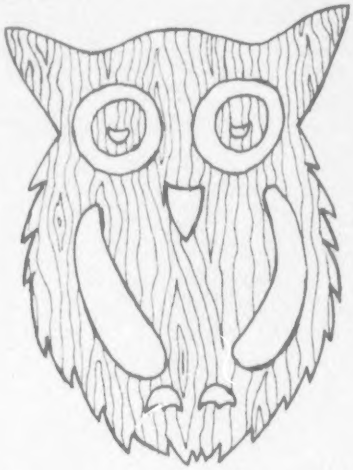
TOOLS & EQUIPMENT: HANDSAW, TINSNIPS, BANDSAW, WOOD RASPS, SURFORM FILE, TEMPLATES, BALLPEEN HAMMER, HAND DRILL, SCREWDRIVER, 1/8" IRON DRILL, BELT SANDER, OXY-ACETYLENE TORCH

PROCEDURES:	REFERENCES:
1. SELECT LUMBER AND CUT TO STATED SIZE - HANDSAW. 2. POSITION TEMPLATES, MARK OUTLINE, AND CUT OUT ON BANDSAW. 3. FILE TO DESIRED SHAPE. ROUND EDGES AS DESIRED. BELT SANDER MAY BE USED. 4. SAND TO REMOVE FILE MARKS AND FINISH WITH DANISH OIL. SURFACE MAY BE BURNED WITH TORCH IF YOU DESIRE THIS EFFECT. 5. SELECT BRASS OR COPPER AND CUT TO STATED SIZE - USE TINSHIPS. 6. POSITION WING TEMPLATES AND MARK OUTLINE. 7. CUT OUT WINGS WITH TIN SNIPS OR TORCH. 8. PEEN WINGS ON TOP SURFACE IF DESIRED. 9. SOLDER 3/4" BRADS ON BACK OF WINGS. 10. POLISH WITH STEEL WOOL AND FINISH WITH GLOSS CLEAR ACRYLIC. 11. NAIL WINGS TO WOOD AND ATTACH HANGER TO BACK. MAKE HANGER OUT OF TIN PLATE.	

TITLE: GREAT HORNED OWL

COST: ________

SKETCH:



MATERIAL:

1 - 1' X 12" X 16" WESTERN RED CEDAR OR PINE

1 - .013" 8" X 8 1/2" BRASS

13 - #18 3/4" WIRE NAILS

2 - #5 1/2" R.H. SCREWS

1 - 24 GA. 12" COPPER WIRE

TOOLS & EQUIPMENT: 24" SCALE, HANDSAW, BANDSAW OR SCROLL SAW, ROUTER, BIT #5096, RASP, DANISH SOLDER GUN, SOLDER, NEEDLE NOSE PLIERS, STEEL WOOL, CLEAR LACQUER, OIL, OXY-ACETYLENE TORCH, WIRE WHEEL, SCREWDRIVER, SIDECUTTER, PLIERS, TIN SNIPS, SOAP STONE

PROCEDURES:

REFERENCES:

1. CUT ONE PIECE OF WESTERN RED CEDAR 12" X 16" WITH HANDSAW.
2. TRACE OWL PATTERN ON BOARD.
3. CUT OUTLINE ON BANDSAW OR SCROLL SAW.
4. CUT FEATHER LINES WITH ROUTER.
5. SHAPE CONTOUR OF OWL WITH WOOD RASP.
6. BURN WOOD SURFACE WITH OXY-ACETYLENE OUTFIT.
7. BRUSH CHARRED WOOD WITH FOXTAIL, WIRE BRUSH OR WIRE WHEEL.
8. FINISH WOOD WITH DANISH OIL. INSTRUCTION IN FINISH AREA.
9. ATTACH 2-1/2" X 5 R.H. WOOD SCREWS ON BACK OF OWL.
10. CONNECT A WIRE TO BOTH SCREWS, TIGHTEN AND TIE SECURELY.
11. CUT A 9" X 9" PIECE OF .013" BRASS WITH TIN SNIPS.
12. WITH SOAP STONE, DRAW THESE PIECES ON THE BRASS: 2 EYES, 2 WINGS, 2 FEET, 1 NOSE.
13. WITH #0 WELDING TIP ON OXY-ACETYLENE TORCH, CUT OUT METAL PARTS.
14. SOLDER ONE OR TWO 3/4" WIRE BRADS ON BACK SIDE OF EACH BRASS PART.
15. CLEAN FINISHED SIDE OF BRASS WITH STEEL WOOL.
16. SPRAY FINISHED SIDE WITH CLEAR LACQUER.
17. LOCATE BRASS PARTS IN PROPER POSITION AND ATTACH BY PUSHING NAILS INTO THE WOOD.

TITLE: WOOD SCULPTURE

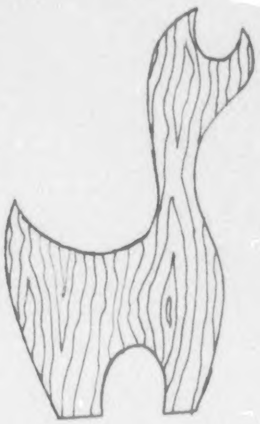
COST: __________

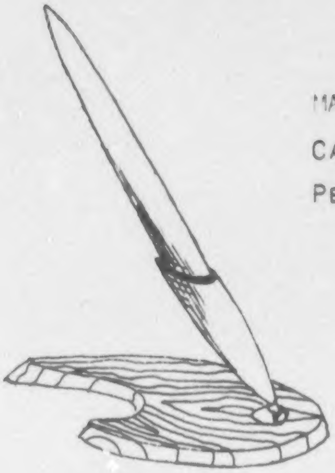
MATERIAL: MAHOGANY WOOD

CAT: 1" X 4" X 12"

PEN HOLDER: 1" X 4" X 6"

SKETCH:





TOOLS & EQUIPMENT: BANDSAW, JIG SAW, HALF ROUND SUREFORM RASP, HALF ROUND AND ROUND BASTARD FILE, COARSE AND MEDIUM SAND PAPER, DANISH OIL, 400 WET OR DRY ABRASIVE PAPER, CROSSCUT SAW, 9/64 DRILL.

PROCEDURES:

1. CHOOSE SCULPTURE SHAPE.
2. TAKE SHEET METAL PATTERN FROM DISPLAY TO LUMBER STORAGE.
3. SELECT WOOD WHICH WILL FIT PATTERN AND LEAVE VERY LITTLE WASTE.
4. TRACE PATTERN ON WOOD.
5. CUT OFF SIZE OF STOCK NEEDED. BEYOND THIS STEP YOU MUST BE CHECKED OUT ON EACH POWER MACHINE BEFORE YOU NEED TO USE.
6. CUT OUT SHAPE USING JIGSAW OR BANDSAW.
7. SHAPE SCULPTURE WITH SUREFORM TOOL AND BASTARD FILES.
8. SAND OUT FILE MARKS, START WITH COARSE TO FINE.
9. SAND ON OIL FINISH.
10. WIPE WITH CLOTH TO POLISH.

ATTACHING PEN HOLDER

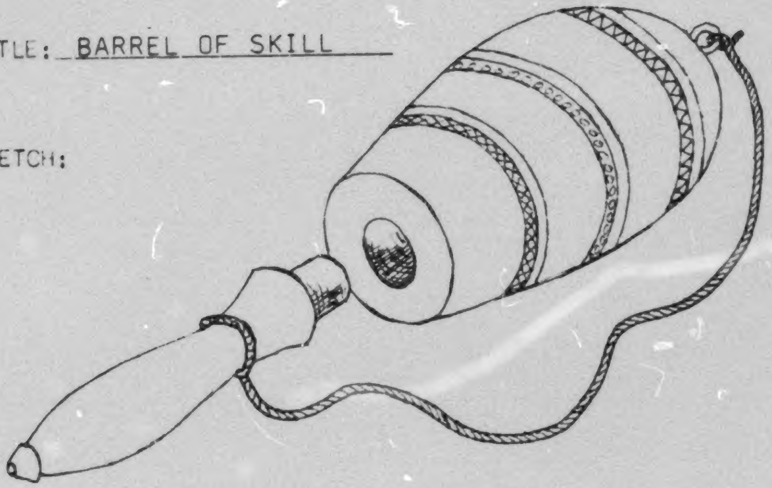
1. DRILL HOLE FOR PEN MOUNT WITH 9/64 DRILL.
2. COUNTERBORE SO THAT 1/3" OF SCREW EXTENDS THROUGH FREE FORM BLOCK.
3. SCREW ON PEN HOLDER.

REFERENCES:

TITLE: BARREL OF SKILL

COST: ____________

SKETCH:



MATERIAL: YOUR CHOICE

1. 1 PC. 2" X 2" X 3 1/2"
2. 1 PC. 1" X 1" X 8"

1 PC. HEAVY STRING 12"

1 SCREW EYE

TOOLS & EQUIPMENT: BACK SAW, LATHE, DRILL PRESS, 3/8" FORSTNER DRILL BIT, RULE, HAND SCREW, SANDPAPER, LATHE TOOLS

PROCEDURES:	REFERENCES:

1. DRESS PROPERLY, CHECK REFERENCES. MOUNT 2" X 2" X 3 1/2" PIECE IN LATHE.
2. TURN TO SIZE AND SHAPE. DECORATE SIMILAR TO MODEL. (MAXIMUM LENGTH 2 3/4", MAXIMUM DIAMETER 2"). (BARREL SHAPED).
3. SAND ON LATHE.
4. REMOVE FROM LATHE, TRIM WASTE FROM TOP END WITH SAW, AND SAND.
5. CLAMP IN HAND SCREW AND DRILL WITH 3/8" FORSTNER DRILL AND DRILL PRESS TO A DEPTH OF 1 1/4", AS ON MODEL.
6. DRILL PILOT HOLE WITH HAND DRILL, AND INSTALL SCREW EYE, AS ON MODEL.
7. MOUNT PIECE NO. 2 IN LATHE AND TURN TO DIMENSIONS AS GIVEN IN FIG. #2.

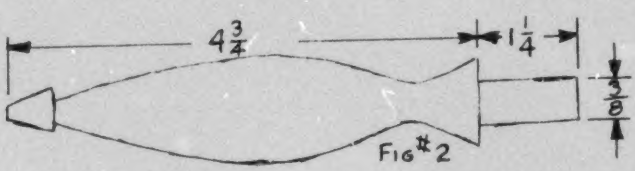


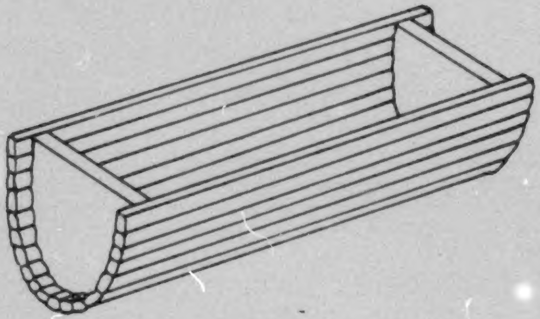
FIG #2

8. SAND, THEN REMOVE FROM LATHE AND TRIM.
9. FINISH WITH OIL FINISH (OTHER FINISH IF DESIRED).
10. TIE STRING AS ON MODEL.

TITLE: HANGING FLOWER BASKET

COST: ________

SKETCH:



MATERIAL:

2 PCS. RED CEDAR, 1" X 6" X 8"

20 PCS. RED CEDAR 1/4" X 1" X 18"

GALVANIZED SHINGLE NAILS

WIRE

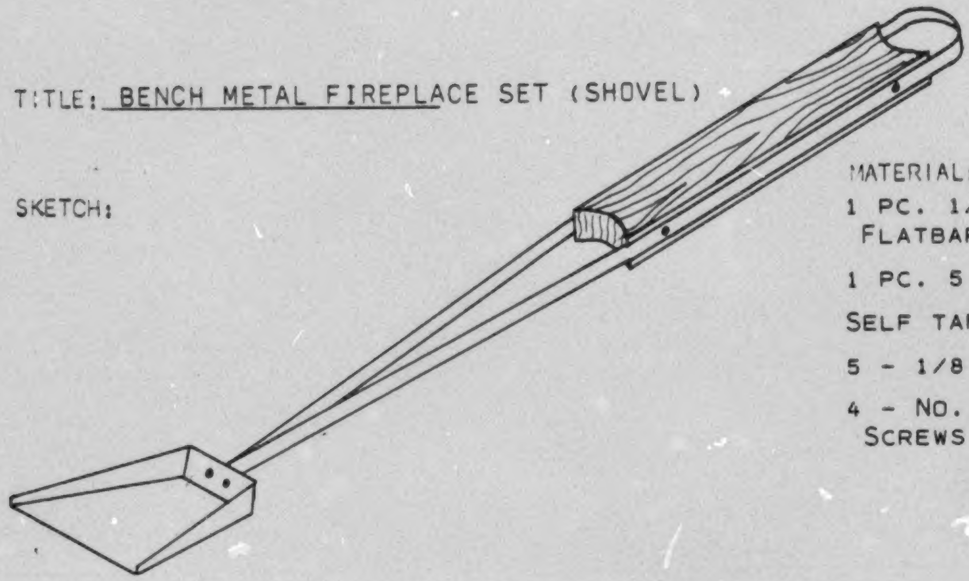
TOOLS & EQUIPMENT: RULE, SQUARE, COMPASS, TABLE SAW, JOINTER OR UNIPLANE, BANDSAW, DISC SANDER, HAMMER, PLIERS

PROCEDURES:	REFERENCES:
1. OBTAIN THE RED CEDAR AND ROUGH CUT.	
2. MEASURE, MARK AND SAW END PIECES WITH THE BANDSAW.	
3. SAND TO LINE WITH THE DISC SANDER.	
4. JOINT ONE EDGE OF LUMBER AND RESAW THE 1/4" X 1" X 18" STRIPS WITH THE BANDSAW.	
5. ASSEMBLE PARTS WITH GALVANIZED SHINGLE NAILS.	
6. OIL WITH DANISH OIL.	
7. CUT AND FIT HANGING WIRE.	

TITLE: BENCH METAL FIREPLACE SET (SHOVEL)

COST: ________

SKETCH:



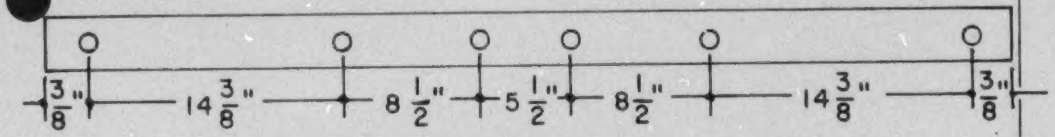
MATERIAL:
1 PC. 1/8" X 1/2" X 52" FLATBAR
1 PC. 5 1/2" X 6 1/4" 20 GA.
SELF TAPPING SCREWS
5 - 1/8 X 3/8 IRON RIVETS
4 - NO. 6 3/4" PAN HEAD SCREWS

TOOLS & EQUIPMENT: HACKSAW, RULE, DRILL, BENDING JIG, BALL PEEN HAMMER, CENTER PUNCH, RIVET SET, FILE, TIN SNIPS, PAN BRAKE, DRILL PRESS, VISE, BAND SAW.

PROCEDURES:

REFERENCES:

1. CUT 52" PIECE OF 1/8 X 1/2 FLATBAR.
2. MARK, CENTER PUNCH, AND DRILL AS SHOWN IN FIG. 1. DRILL TWO END HOLES 1/8", THE REST 5/32.



3. REMOVE BURR EDGES WITH FILE.
4. FIND CENTER AND BEND OVER 1 1/2" PIPE.
5. LAYOUT ENDS AS SHOWN IN FIG. 3. PLACE IN VISE AND BEND AS ON SHOP MODEL.

FIG. 3

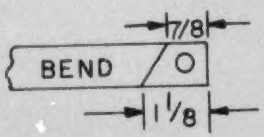
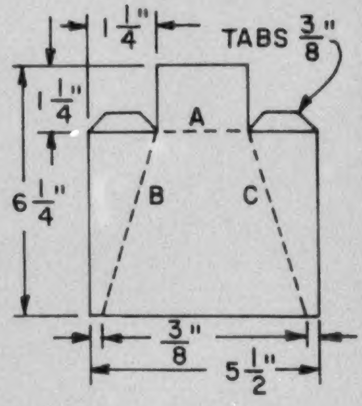


FIG. 4



6. DRILL AND RIVET TWO ENDS TOGETHER AS ON SHOP MODEL.
7. LAYOUT BLACK IRON FOR SHOVEL AS SHOWN IN FIG. 4.
8. CUT OUT WITH TIN SNIPS.
9. BEND ON PAN BRAKE AS ON SHOP MODEL.
10. DRILL AND RIVET BACK OF SHOVEL AS ON SHOP MODEL.
11. DRILL AND RIVET HANDLE TO BACK OF SHOVEL AS ON SHOP MODEL.
12. SELECT, LAYOUT WITH TEMPLATE, AND CUT WOOD FOR HANDLE.

BENCH METAL FIREPLACE SET (SHOVEL)

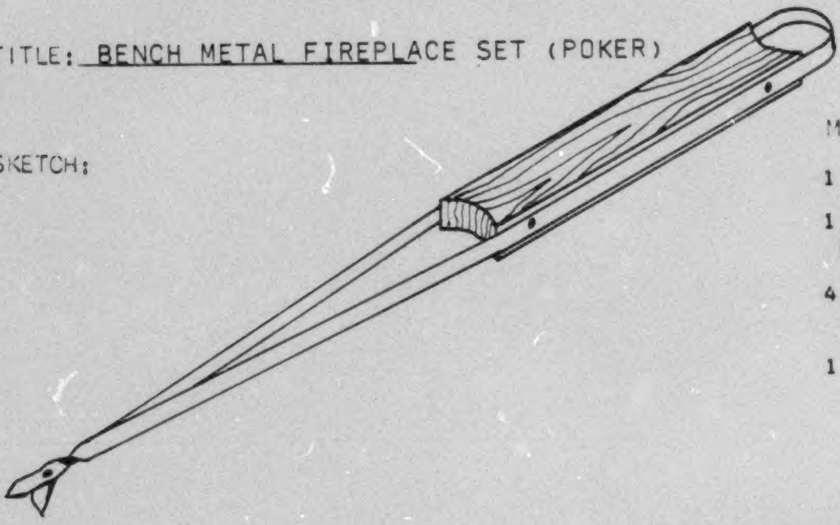
13. SAND SMOOTH AND FINISH WITH OIL.

14. PLACE WOOD INSERT ON HANDLE, MARK, DRILL 3/32 PILOT HOLES, AND FASTEN WITH FOUR PAN HEAD SCREWS AS ON MODEL.

TITLE: BENCH METAL FIREPLACE SET (POKER)

COST: ________

SKETCH:



MATERIAL:

1 PC. 1/8 X 1/2 X 60" FLATBAR

1 PC. 1 X 1 1/2 X 11" HARDWOOD

4 - NO. 6 3/4" PAN HEAD SCREWS

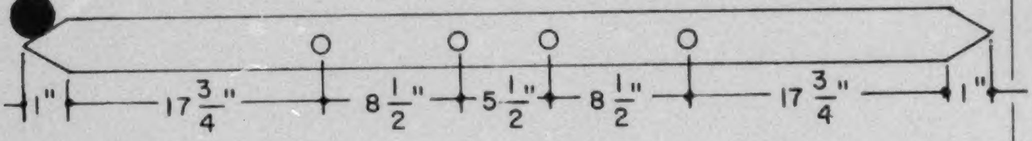
1 - 1/8 X 3/8 IRON RIVET

TOOLS & EQUIPMENT: HACKSAW, RULE, RILL PRESS, BENDING JIG, BALL PEEN HAMMER, CENTER PUNCH, FILE, ADJUSTABLE WRENCH, SCREWDRIVER, 5/32 & 3/32 DRILLS.

PROCEDURES:

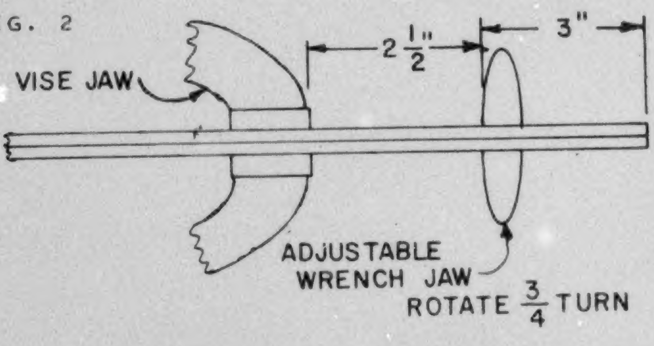
REFERENCES:

1. CUT 60" PIECE OF 1/8 X 1/2 FLATBAR.
2. LAYOUT, CENTER PUNCH, AND DRILL 5/32" HOLES AS SHOWN IN FIG. 1 USING DRILL PRESS.



3. LAYOUT AND TAPER ENDS AS SHOWN IN FIG. 1, WITH HACKSAW OR FILE REMOVE DRILLING BURR WITH FILE.
4. FIND CENTER AND BEND OVER 1 1/2" PIPE.
5. PLACE IN VISE AT POINT A SHOWN IN FIG. 2. PLACE 12" ADJUSTABLE WRENCH AT POINT B, LEAVING 2 1/2" BETWEEN VISE AND FACE OF WRENCH. TURN WRENCH 3/4 REVOLUTIONS. SEE SHOP MODEL.

FIG. 2



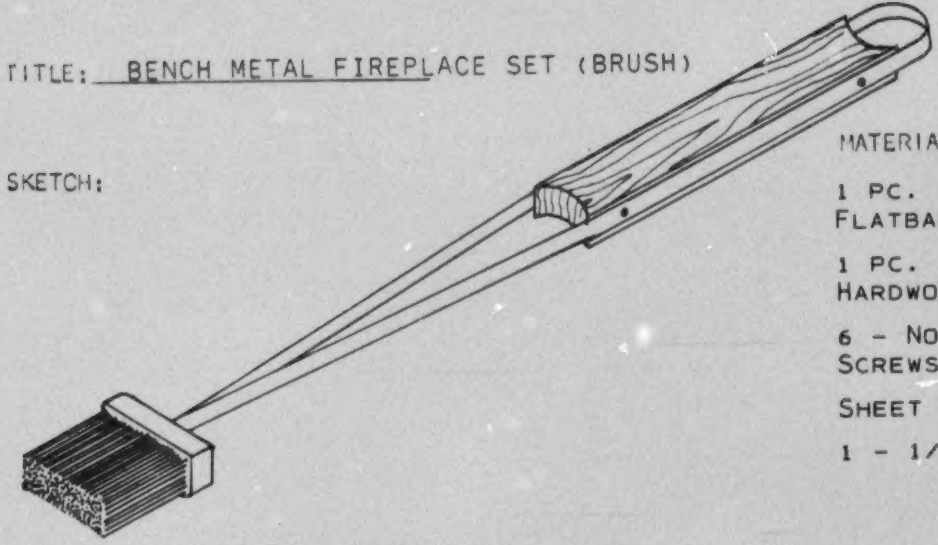
6. MOVE UP IN VISE, CENTER PUNCH AT POINT C, FIG. 3, AND DRILL WITH 1/8 DRILL. INSTALL 1/8" SOFT IRON RIVET AS SHOWN ON SHOP MODEL.
7. PLACE IN VISE AND BEND POINT OF POKER AS IN SHOP MODEL.

8. SPRAY WITH BLACK PAINT.
9. SELECT, LAYOUT WITH TEMPLATE AND CUT WOOD FOR HANDLE INSERT.
10. SAND SMOOTH AND FINISH WITH OIL.
11. WHEN FINISHES ARE DRY, PLACE WOOD INSERT IN HANDLE DRILL 1/8" PILOT HOLES AND FASTEN IN PLACE WITH 4 PAN HEAD SHEET METAL SCREWS, AS SHOWN ON SHOP MODEL.

TITLE: BENCH METAL FIREPLACE SET (BRUSH)

COST: ____________

SKETCH:



MATERIAL: 1 BRUSH BLANK

1 PC. 1/8" X 1/2" X 52" FLATBAR

1 PC. 1" X 1 1/2" X 11" HARDWOOD

6 - NO. 6 3/4" PAN HEAD SCREWS

SHEET METAL SCREWS

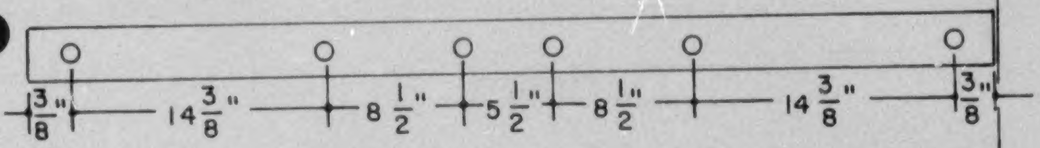
1 - 1/8" X 3/8" IRON RIVET

TOOLS & EQUIPMENT: HACKSAW, RULE, DRILL PRESS, BENDING JIG, BALL PEEN HAMMER, 5/32 AND 3/32 DRILLS, BANDSAW, SANDER, CENTER PUNCH, SCREWDRIVER, FILE, DRILL PRESS, VISE.

PROCEDURES:

REFERENCES:

1. CUT FLATBAR WITH HACKSAW.
2. MARK, CENTER PUNCH, AND DRILL AS SHOWN IN FIG. 1. DRILL ALL HOLES 5/32".



3. REMOVE BURR EDGES WITH FILE.
4. FIND CENTER AND BEND OVER 1 1/2 PIPE.
5. MARK AND BEND OUT TO RIGHT ANGLES 1 1/2" FROM EACH END AS ON SHOP MODEL.
6. MARK WITH CENTER PUNCH 1" FROM BRUSH END, CLAMP IN DRILL PRESS VISE AND DRILL 1/8" HOLE THROUGH BOTH SIDES FOR 1/8" RIVET ON DRILL PRESS.
7. RIVET TWO SIDES TOGETHER AS ON SHOP MODEL.
8. CENTER HANDLE ON BRUSH, MARK, THEN DRILL 3/32" PILOT HOLE 1/2" DEEP.
9. FASTEN BRUSH TO HANDLE WITH TWO NO. 6 PAN HEAD SHEET METAL SCREWS.
10. SPRAY ALL BUT BRISTLE PART OF BRUSH WITH FLAT BLACK PAINT.
11. SELECT, LAYOUT WITH TEMPLATE, AND CUT WOOD ON BANDSAW FOR HANDLE INSERTS.
12. SAND SMOOTH AND FINISH WITH OIL FINISH.
13. WHEN FINISHES ARE DRY, PLACE WOOD INSERT IN HANDLE, DRILL 3/32" PILOT HOLES AND FASTEN IN PLACE WITH FOUR PAN HEAD SHEET METAL SCREWS AS SHOWN ON SHOP MODEL.

TITLE: FIREPLACE TOOL HANGER

COST: ________

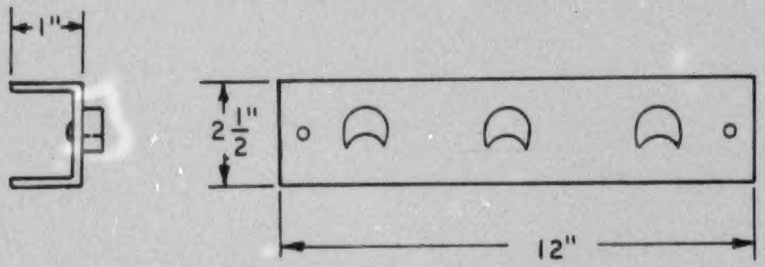
MATERIAL:

1 PC. 16 OR 18 GA. SHEET STEEL 4 1/2" X 12"

1 PC. WALNUT 1 1/2" X 5" X 3/4"

6 - 1/2 X 6 PAN HEAD SHEET METAL SCREWS

SKETCH:



TOOLS & EQUIPMENT: BAND SAW, DRILL PRESS, DISC SANDER, METAL SHEAR, BOX & PAN BRAKE, ELECTRIC HAND DRILL, 1/4", 1/8", & 3/32" TWIST DRILLS, FILE, SCREWDRIVER, SANDPAPER

PROCEDURES:

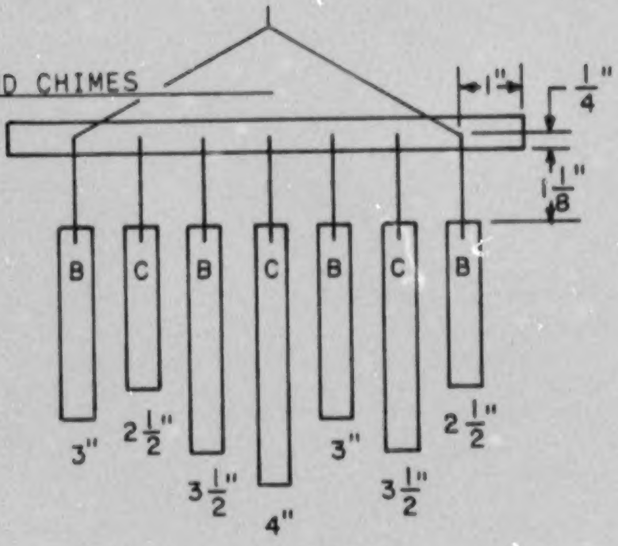
1. USING THE HANGER PART OF THE HANDLES OF YOUR PREVIOUSLY CONSTRUCTED FIREPLACE TOOLS AS A TEMPLATE, DRAW HANGER BLOCK DESIGNS ON WALNUT.
2. CUT OUT ON BAND SAW.
3. SAND CONVEX SURFACE ON DISC SANDER.
4. SAND CONCAVE SURFACE USING 11/16" DRUM SANDER ON DRILL PRESS.
5. HAND SAND UNTIL SMOOTH. CHAMFER FACE SURFACE 1/16".
6. APPLY DANISH OIL FINISH.
7. CUT 1 PC. OF 18 GA. SHEET STEEL 4 1/2" X 12" USING METAL SHEAR.
8. REMOVE SHARP EDGES WITH FILE.
9. USING THE TEMPLATE, MARK AND CENTER PUNCH HOLE POSITIONS.
10. DRILL HOLES USING DRILL PRESS AND PROPER DRILL SIZES.
11. LAY OUT BEND LINES 1" FROM EDGE ON THE LONG SIDE OF SHEET STEEL.
12. BEND TO 90° ON BOX & PAN BRAKE.

REFERENCES:

TITLE: WIND CHIMES

COST: __________

SKETCH:



MATERIAL:

1 PC. 1/8 X 1/2 X 6"

B - 1 PC. 20 GA. 1/2 X 12" BRASS

C - 1 PC. 20 GA. 1/2 X 10" COPPER

NYLON FISH LINE 8 LBS OR MORE

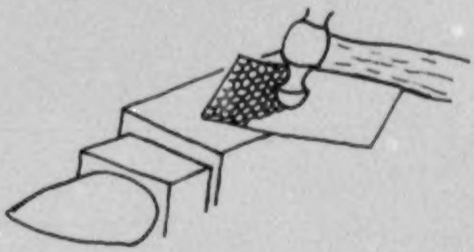
BLACK PAINT SPRAY CAN

TOOLS & EQUIPMENT: STEEL SCALE, HACKSAW, FILE, CENTER PUNCH, DRILL PRESS, BALL PEEN HAMMER, VISE, 1/8" TWIST DRILL, STEEL WOOL, TIN SNIPS, ANVIL, SCRATCH AWL, DRILL PRESS VISE

PROCEDURES:

REFERENCES:

1. CUT MILD STEEL TO LENGTH WITH HACKSAW.
2. MARK COPPER AND BRASS WITH AWL AND CUT TO EACH LENGTH WITH A TIN SNIP.
3. MARK, CENTER PUNCH AND DRILL HOLES. USE DRILL PRESS AND DRILL PRESS VISE.
4. PEEN FACES OF COPPER AND BRASS TO MAKE HARDER.



5. FILE EDGES SMOOTH.
6. POLISH ALL EDGES USING ONLY STEEL WOOL.
7. SPRAY PAINT MILD STEEL ONLY.
8. TIE TOGETHER AS IN SAMPLE

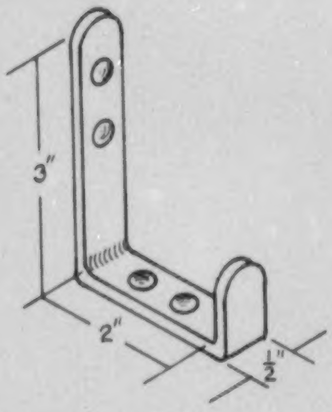
   7 PIECES OF LINE 4" LONG

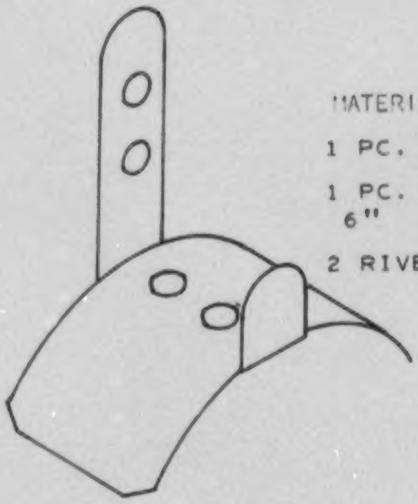
   1 PIECE OF LINE 7" LONG

TITLE: EXTENSION CORD HOLDER

COST: ____________

SKETCH:





MATERIAL:

1 PC. SHEET METAL 2" X 6"

1 PC. FLAT BAR 1/8" X 1/2" X 6"

2 RIVETS R.H.S. 1/8" X 3/8"

TOOLS & EQUIPMENT: HACKSAW, DRILL PRESS, GRINDER, STEEL SCALE, VISE, BALL PEEN HAMMER, SQUARING SHEAR, TIN SNIPS, FORMING ROLL, ELECTRIC DRILL, FILE, RIVET SET, 1/16" , TWIST DRILL, ABRASIVE CLOTH

PROCEDURES:

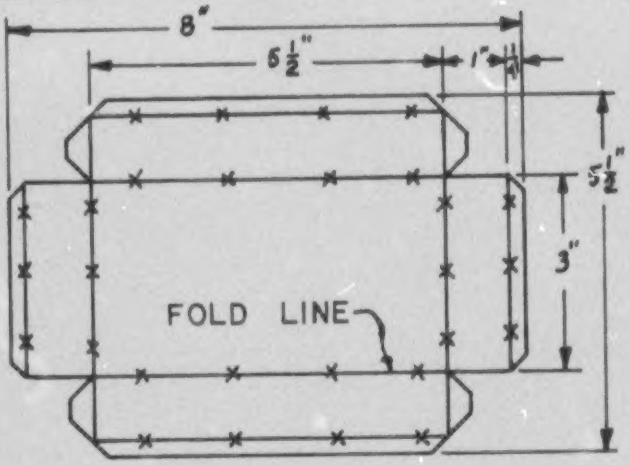
REFERENCES:

1. CUT 1 PIECE OF 1/8" FLAT SCROLL BAR 6" LONG USING HACKSAW.
2. ROUND OFF ENDS ON GRINDER OR WITH A FILE.
3. CENTER PUNCH 2 RIVET HOLES AND 2 MOUNTING HOLES.
4. DRILL FOUR 1/8" HOLES, DRILL PRESS OR ELECTRIC DRILL.
5. SHAPE FLAT BAR AS SHOWN IN SKETCH.
6. CUT 1 PIECE OF SHEET METAL 2" X 6" .
7. CUT 1/4" DIAGONALLY ACROSS EACH CORNER.
8. FILE EDGES TO REMOVE BURR.
9. ROLL TO DESIRED SHAPE IN FORMING ROLL.
10. CLAMP SHEET METAL TO FLAT BAR AND DRILL RIVET HOLES THROUGH SHEET METAL.
11. RIVET SHEET METAL TO FLAT BAR.
12. SAND ALL EDGES TO RELIEVE SHARPNESS.
13. PAINT WITH DESIRED COLOR.

TITLE: SHEET METAL BOX

COST: ________

SKETCH:



MATERIAL:

1 PC. 26 GA. STEEL, 5 1/2" X 8"

60/40 SOFT SOLDER

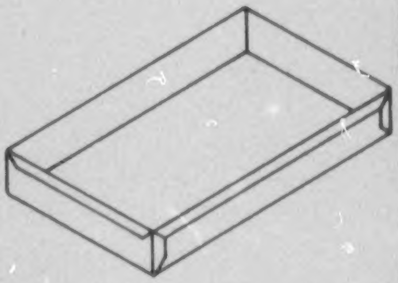
TOOLS & EQUIPMENT: FOOT SQUARING SHEAR, STRAIGHT SNIPS, STAKE & MALLET, BAR FOLDER, BOX & PAN BRAKE, SOLDERING IRON & FURNACE, OR SPOT WELDER

PROCEDURES:

MEASUREMENTS CAN BE ALTERED. SEAM 1/4 TO SOLDER. 3/8 TO SPOT WELD.

1. SELECT SHEET OR TIN PLATE (GAUGES 31 ON U.S. STANDARD GAUGE) OR 26 GAUGE STEEL.
2. MEASURE & MARK RECTANGLE 5 1/2 X 8. USE SCRIBE AND COMBINATION SQUARE.
3. CUT USING FOOT SQUARING SHEAR (MAKE ECONOMICAL USE OF MATERIAL).
4. USING SCRIBE AND COMBINATION SQUARE MARK LINES FOR BOTTOM, HEM AND TABS SEAMS OF BOX ON METAL, OR MAKE CARDBOARD PATTERN AS IN FILM LOOP.
5. REMOVE UNUSED OR WASTE PORTIONS WITH THE STRAIGHT SNIPS.
6. SET THE BAR FOLDER ON 1/4" AND FOLD OVER THE HEMS. (PUT LINES DOWN SO ALL HEMS ARE ON THE OUTSIDE).
7. SET BAR FOLDER ON 1" AND FOLD SIDES TO 90 DEGREES (SQUARE).
8. PLACE 3" FINGER ON BOX AND PAN BRAKE.
9. FOLD ENDS SQUARE.
10. IF FOLDS HAVE SPRUNG BACK TAP ON STAKE WITH MALLET.
11. TAP TABS (SEAMS) OVER SIDES WITH STAKE & MALLET.
12. SOLDER WITH 60/40 SOFT SOLDER IN HOT METAL AREA, OR SPOT WELD WITH SPOT WELDER SET ON 3 1/2 FOR TIN PLATE, BETWEEN 5 AND 10 FOR 26 GA. IF YOU MADE 3/8" TABS (SEAMS).
13. HANDLES OR LIDS OF YOUR OWN DESIGN MAY BE ADDED.

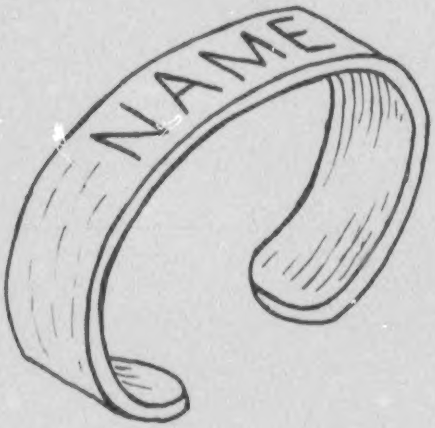
REFERENCES:



TITLE: ENGRAVED WRIST BAND

COST: ________

SKETCH:



MATERIAL:

.040 THICK X 1" WIDE X 6" LONG ALUMINUM BAND T6 HARD

TOOLS & EQUIPMENT: VIBRO ENGRAVER, SINGLE CUT FILE, BUFFING MACHINE, SQUARING SHEAR, TIN SNIPS, FOOT RULE, TAPE, 1 1/4" ROUND PIPE OR BAR

PROCEDURES:

1. CUT MATERIAL 1 INCH X 6 INCHES WITH TIN SNIPS OR SQUARING SHEARS.
2. CUT AND FILE BAND TO DESIRED SHAPE.
3. LAYOUT DESIGN OR NAME ON A 1 INCH X 6 INCH PIECE OF PAPER.
4. POLISH ALL SURFACES OF ALUMINUM WRIST BAND BLANK ON BUFFER.
5. PLACE PAPER PATTERN OVER METAL BLANK AND TAPE IN PLACE.
6. ENGRAVE NAME AND DESIGN ON METAL WITH VIBRO ENGRAVER.
7. BEND TO FIT WRIST BY HAND AND BY LAYING IT OVER A ROUND PIPE OR BAR AND TAPPING WITH RAWHIDE MALLET.

REFERENCES:

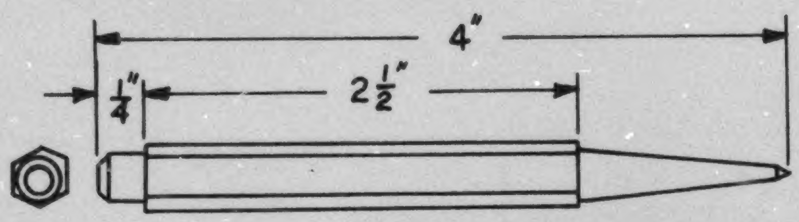
TITLE: CENTER PUNCH

COST: __________

MATERIAL:

5/16" X 4" HEXAGONAL TOOL STEEL

SKETCH:



TOOLS & EQUIPMENT: METAL LATHE, CHUCK WRENCH, TOOL BIT AND HOLDER, RULE, FILES, EMERY CLOTH, BENCH FURNACE, FILE CARD

PROCEDURES:

1. OBTAIN 5/16" TOOL STEEL.
2. TIGHTEN IN LATHE CHUCK.
3. FACE END.
4. STRAIGHT TURN HEAD END FOR 1/4".
5. FILE SMOOTH, CAMFER EDGE AND POLISH.
6. REVERSE STOCK IN CHUCK.
7. SET COMPOUND REST AT 5° AND HAND FEED TO CUT THE TAPER. (DEPTH OF CUT IS SET WITH CROSS FEED).
8. FILE SMOOTH AND POLISH.
9. SET COMPOUND REST AT 120° AND CUT POINT.
10. HARDEN AND TEMPER TO A PURPLE COLOR.
11. RE-POLISH.

REFERENCES:

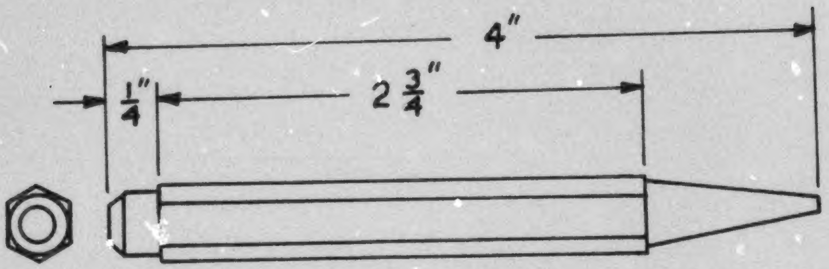
TITLE: NAIL SET

COST: __________

MATERIAL:

5/16" X 4" HEXAGONAL TOOL STEEL

SKETCH:



TOOLS & EQUIPMENT: METAL LATHE, TOOL BIT AND HOLDER, RULE, FILES, EMERY CLOTH, BENCH FURNACE, FILE CARD

PROCEDURES:

REFERENCES:

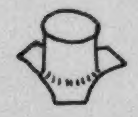
1. OBTAIN 5/16" TOOL STEEL.
2. TIGHTEN IN LATHE CHUCK.
3. FACE END.
4. STRAIGHT TURN END FOR 1/4".
5. FILE SMOOTH, CAMFER EDGE AND POLISH.
6. REVERSE STOCK IN CHUCK.
7. FACE END.
8. CONCAVE END. USE ROUND NOSE TOOL OR A DRILL.
9. SET COMPOUND REST AT 5° AND TURN THE TAPER.
10. FILE SMOOTH, CAMFER THE EDGE AND POLISH.
11. HARDEN AND TEMPER.
12. RE-POLISH.

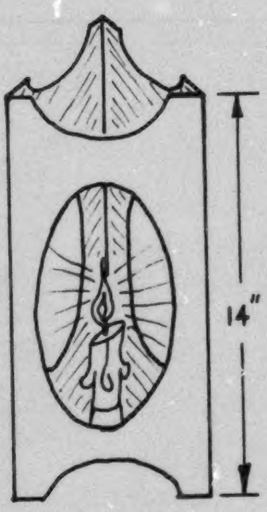
NOTE: NAIL SETS MAY BE MADE IN A VARIETY OF SIZES.

TITLE: WELDED CANDLE HOLDER

COST: ____________

SKETCH:





MATERIAL:

22 GA. BLACK IRON
3 PCS 6" X 14"

1 PC. 3/4" PIPE 1" LONG

TOOLS & EQUIPMENT: METAL SHEAR, FORMING ROLL, OXY-ACETYLENE WELDING SET, WELDING VISE GRIPS, HACK SAW

PROCEDURES:

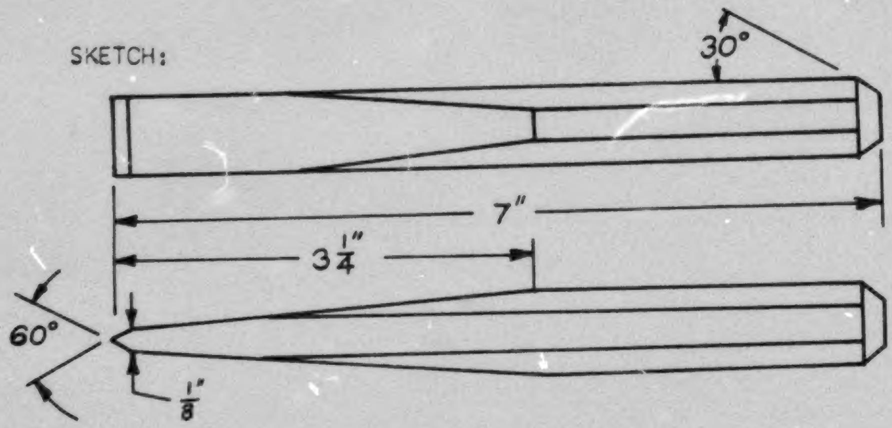
1. CUT OUT STOCK - METAL SHEAR.
2. TRACE PATTERN ON ALL THREE PIECES, WITH SOAP STONE.
3. SHAPE SIDES IN FORMING ROLL.
4. USING #0 CUTTING TIP, OXY-ACETYLENE, CUT THE THREE PIECES TO SHAPE. SAVE 1 PIECE OF CENTER CUT-OUT FOR LATER USE.
5. ASSEMBLE TWO SIDES TOGETHER. HOLDING WITH WELDING VICE GRIPS. USE THREE VICE GRIPS.
6. USING #0 OR #1 WELDING TIP, OXY-ACETYLENE FUSION WELD, (WELD WITHOUT ROD), 11 SPOTS ALONG THE EDGE, EQUALLY SPACED.
7. RELEASE THE THREE CLAMPS.
8. WELD WITHOUT ROD ALONG THE ENTIRE EDGE, COMBINING ALL SPOTS THAT HELD THE SIDES TOGETHER.
9. CLAMP THE THIRD SIDE IN PLACE AND SPOT IT TO ONE OTHER SIDE.
10. WELD WITHOUT ROD ALONG THIS EDGE.
11. COMPLETE THE THIRD EDGE IN THE SAME MANNER DESCRIBED.
12. CUT OUT PIECE WHICH FITS INTO BOTTOM AND HOLDS CONDUIT. (CENTER CUT-OUT).
13. CUT 1" LONG PIECE OF 3/4" CONDUIT AND BRAZE IT TO SMALL SHAPED PIECE OF METAL.
14. FIT THIS ASSEMBLY INTO BOTTOM OF CANDLE HOLDER AND BRAZE ROD INTO PLACE.
15. TO COMPLETE DECORATION OF CANDLE HOLDER, MELT BRAZING ROD AROUND ALL EDGES OF ASSEMBLY AT APPROXIMATELY 1" INTERVALS.

REFERENCES:

TITLE: COLD CHISEL

COST: ________

SKETCH:



MATERIAL:

1/2" X 7" OCTAGON TOOL STEEL

EMERY

STEEL WOOL

TOOLS & EQUIPMENT: FORGE, ANVIL, BLACKSMITH HAMMER, TONGS, FILES, GRINDER, BUFFING WHEEL

PROCEDURES:

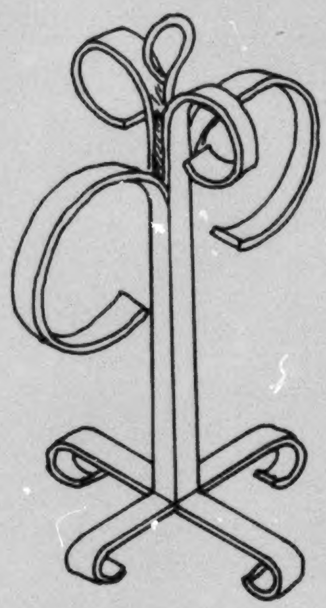
1. USE A HALF ROUND DOUBLE-CUT BASTARD FILE TO CUT OFF A PIECE OF 1/2" DIAMETER OCTAGON TOOL STEEL 7" LONG.
2. HEAT OCTAGON TOOL STEEL IN FORGE TO BRIGHT RED AND FORGE TO A TAPER. SEE DRAWING.
3. CONTINUE TO HEAT OCTAGON TOOL STEEL TO A BRIGHT RED AND FORGE TAPER UNTIL COMPLETED. CAUTION: WHEN METAL IS NO LONGER BRIGHT RED IN COLOR, STOP FORGING AND REHEAT.
4. ANNEAL THE PIECE OF OCTAGON TOOL STEEL BY HEATING TO A BRIGHT RED AND PUTTING IN SAND TO COOL OVERNIGHT.
5. NEXT DAY, USE A DOUBLE CUT BASTARD FILE TO REMOVE FORGING MARKS.
6. DRAW FILE THE CHISEL WITH A SINGLE CUT MILL FILE.
7. POLISH A CHISEL WITH A PIECE OF COARSE ABRASIVE CLOTH, THEN A PIECE OF FINE ABRASIVE CLOTH.
8. HARDEN AND TEMPER THE CUTTING END.
9. GRIND THE HEAD AND CUTTING EDGE TO SHAPE AS IN THE DRAWING.
10. TEST FOR HARDNESS BY CUTTING ON A SCRAP PIECE OF METAL.
11. POLISH WITH A FINE PIECE OF ABRASIVE CLOTH.
12. POLISH ON BUFFING WHEEL.

REFERENCES:

TITLE: DECORATIVE MUG TREE

COST: __________

SKETCH:



MATERIAL:

2 - 1/8" X 1/2" X 11" FLAT BAR

1 - 1/4" X 15" ROUND STOCK

2 - 1/8" X 3/8" X 7" FLAT BAR

2 - 1/8" X 3/8" X 14" FLAT BAR

1 - 1/4 - 20 HEX NUT

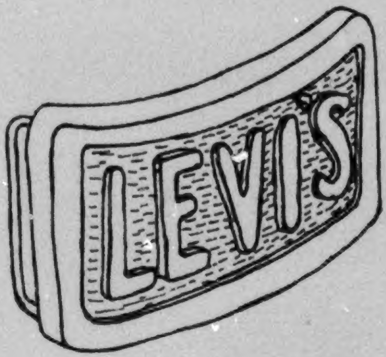
TOOLS & EQUIPMENT: HACK SAW, FILE, DIACRO METAL FORMER, DRILL, TAP AND DIE, SILVER SOLDER, TORCH, FORGE, HAMMER, ABRASIVE PAPER, PAINT.

PROCEDURES:	REFERENCES:
1. OBTAIN STOCK AND CUT ALL PIECES TO LENGTH USING HACK SAW.	
2. FORGE RECESS IN BOTTOM SUPPORT.	
3. LAYOUT AND DRILL HOLE THROUGH BOTH SUPPORTS (USE CORRECT DRILL SIDE).	
4. TAP HOLE IN TIP CROSS SUPPORT.	
5. THREAD ROUND STOCK APPROXIMATELY 1/2 INCH.	
6. USING DIACRO BENDER, FORM LOOPS ON SUPPORT ENDS.	
7. FORM CUP HANGERS ON DIACRO. MAKE EACH BEND THE SAME. FORM TOP LOOP.	
8. FILE AND SMOOTH ALL RAW EDGES.	
9. ASSEMBLE BOTTOM SUPPORTS WITH UPRIGHT ROD.	
10. SILVER SOLDER CUP HANGERS AND TOP LOOP TO ROD AND TOP SUPPORT MEMBER.	
11. FINISH SURFACES AND PREPARE FOR PAINT.	
12. SPRAY PAINT WITH PRIMER AND FINISH COAT. INSTRUCTIONS IN FINISH AREA.	

TITLE: STYROFOAM CASTING - BELT BUCKLE

COST:

SKETCH:



MATERIAL:

STYROFOAM

ALUMINUM OR BRASS

BRASS OR STEEL WIRE

TOOLS & EQUIPMENT: SHARP KNIFE, WOOD-BURNING TOOLS, BALL POINT PEN, SAND PAPER, WIRE CUTTERS, FOUNDRY TOOLS

PROCEDURES:

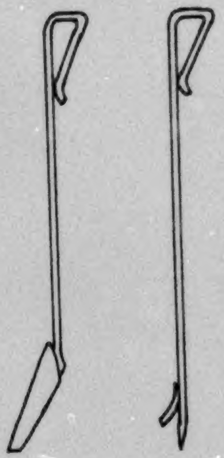
REFERENCES:

1. SELECT PROJECT IDEA: EXAMPLE -- BELT BUCKLE.
2. CHOOSE PIECES OF STYROFOAM LARGE ENOUGH FOR PROJECT.
3. CARVE STYROFOAM INTO SHAPE.
4. SAND WITH #100 SAND PAPER.
5. LAYOUT (DRAW) DESIGN ON STYROFOAM WITH BALL POINT PEN. YOU MAY ALSO USE A WOOD-BURNING TOOL.
6. CARVE RELIEF WITH SHARP KNIFE.
7. BEND 1/8" WIRE ROD TO CORRECT SIZE FOR HOLDING BELT TO BUCKLE.
8. PUSH WIRE INTO STYROFOAM.
9. PUSH SHORT PIECE OF WIRE FOR BELT HOLE.
10. POSITION STYROFOAM PATTERN IN FLASKS AND RAM ACCORDING TO REGULAR RAMMING PROCEDURE ABOVE FOUNDRY AREA. OMIT PROCEDURE #17 AND #18. IMPORTANT: DO NOT REMOVE STYROFOAM PATTERN FROM SAND.

TITLE: FIREPLACE POKER AND SHOVEL

COST: ____________

SKETCH:



MATERIAL:

1 PC. 1/4" X 1/2" X 36 1/8" FLAT STEEL

1 PC. 1/4" X 1/2" X 3 1/2" FLAT STEEL

1 PC. 1/4" X 1/2" X 2 3/4" FLAT STEEL

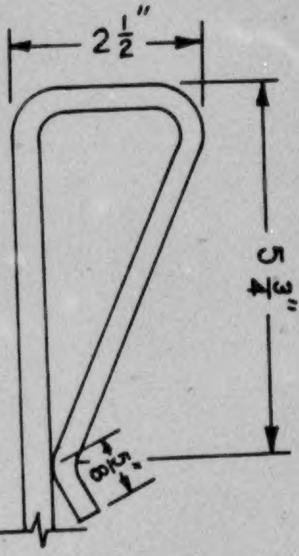
1 PC. 16 GA. 6 7/16" X 6 7/8"

TOOLS & EQUIPMENT: METAL CUTTING BAND SAW, HACKSAW, OXY-ACETYLENE WELDER, BALL PEEN, HAMMER, STEEL RIVETS, METAL VICE, GRINDER, DRILL PRESS

PROCEDURES:

1. SELECT 1/4 X 1/2 FLAT STEEL.
2. CUT ONE PIECE 36 1/8" LONG ON METAL CUTTING BAND SAW OR HACKSAW (POKER).
3. CUT ONE PIECE 32 1/2" LONG USING THE SAME PROCEDURE (SHOVEL).
4. CUT ONE PIECE 2 3/4" LONG USING THE SAME PROCEDURE.
5. BEND HANDLE PORTION ON BOTH LONG PIECES IN THE METAL VICE TO THE DIMENSIONS SHOWN IN SKETCH ABOVE. THE OXY-ACETYLENE WELDER MAY BE USED TO HEAT THE STEEL FOR EASIER BENDING.
6. IF A TWIST IS DESIRED, MARK OFF A SECTION AND HEAT IT WITH THE TORCH. AN ADJUSTABLE WRENCH IS USED TO TWIST THE STEEL.
7. GRIND DESIRED ANGLE ON ONE END OF SHORTEST PIECE, AND WELD THIS PIECE TO THE POKER SHAFT.
8. YOU ARE NOW READY TO START WORK ON THE SHOVEL. USE U.S. STANDARD SHEET METAL GAUGE TO SELECT A PIECE OF 16 GAUGE H.R. STEEL.
9. USING SCRIBE AND COMBINATION SQUARE LAYOUT A 6 7/16 X 6 7/8 RECTANGLE OR USE TEMPLATE.
10. CUT WITH FOOT SQUARING SHEAR.
11. PLACE TEMPLATE ON 17 GAUGE METAL MARK FOR CUT OUT AREAS AND MARK TWO HOLES. SCRIBE ON LINES TO FOLD. CUT OUT ON BEVERLY SHEAR. TAP FLAT WITH MALLET.
12. PLACE ONE 6" FINGER ON BAR FOLDER SO THERE IS EMPTY SPACE ON BOTH ENDS. ADJUST ECCENTRIC SO FINGER IS BACK 1 1/2 TO 2 TIMES THE METAL THICKNESS FROM THE FORMING BAR.

REFERENCES:



13. FOLD THE TWO SIDES TO APPROXIMATELY 55° (THIS WILL BEND TIPS ON BACK).
14. PLACE BACK EDGE IN VISE AND STRAIGHTEN. LINE FOLD LINE WITH VISE TOP AND BEND UNTIL EDGES MEET. TAP WITH MALLET TO FORM A GOOD BUTT JOINT.
15. WELD CORNERS STARTING AT OUTER EDGE. USE NUMBER 0 TIP AND 1/16" MOLD STEEL ROD.
16. DRILL TWO 1/8" HOLES 1" APART AT BOTTOM END AND CENTER OF SHOVEL HANDLE.
17. DRILL ONE 1/8 HOLE IN SHOVEL BACK CENTER. INSERT RIVET THROUGH HANDLE AND SHOVEL HOLES AND PEEN UNTIL FLAT. NOW DRILL THE OTHER HOLE AND PEEN THE RIVET.
18. CLEAN ENTIRE SET WITH SILICON CARBIDE (320).
19. APPLY BLACK FINISH.

TITLE: STYROFOAM CASTING

COST: ______

MATERIAL:

1 PC. 1 3/8" X 2 1/2" X 3"
STYROFOAM

CASTING ALUMINUM

SKETCH:

SKETCH OF YOUR CHOICE

TOOLS & EQUIPMENT: COPING SAW, FILE, SANDPAPER, TIN CAN, SMALL PIECE OF WOOD, HACK SAW, VISE, WIRE BRUSH, SOAP, WATER. SAFETY EQUIPMENT: FACE SHIELD, ASBESTOS GLOVES, PENCIL

REFERENCES:

PROCEDURES:

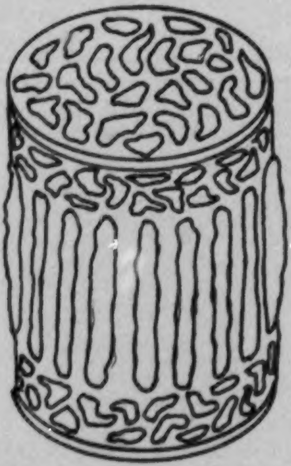
1. DRAW A DESIGN ON PAPER NO LARGER THAN A RECTANGLE 2 1/2 X 3 AND CUT IT OUT.
2. OBTAIN STYROFOAM AND TRACE DESIGN ON TO STYROFOAM WITH A PENCIL.
3. CUT OUT DESIGN WITH A COPING SAW. BE CAREFUL-- STYROFOAM BREAKS EASILY.
4. SHAPE YOUR DESIGN WITH A FILE.
5. SAND SMOOTH WITH SANDPAPER OR TEXTURE AS YOU DESIRE.
6. PUT YOUR STYROFOAM DESIGN IN LOCKER FOR STYROFOAM.
7. GO TO THE CASTING AREA. DO NOT TAKE STYROFOAM. STEPS 8 TO 18 FOR PRACTICE ONLY.
8. USE A TIN CAN AND A SMALL PIECE OF WOOD. HAVE WOOD ABOUT THE SIZE OF YOUR STYROFOAM DESIGN.
9. WATCH THE LOOP FILM ON STYROFOAM CASTING.
10. RIDDLE SAND ON A BOARD.
11. PUT RIDDLED SAND IN THE BOTTOM OF THE TIN CAN.
12. PLACE THE PIECE OF WOOD IN THE TIN CAN ON THE RIDDLED SAND AND PACK TIGHT WITH FINGERS.
13. MAKE SURE THE WOOD DOES NOT TOUCH THE SIDES AND BOTTOM OF THE TIN CAN.
14. FILL THE TIN CAN UP WITH SAND. KEEP IN MIND WHERE THE PIECE OF WOOD IS.
15. TAKE A SLICK AND SPOON AND CUT A HOLE THROUGH THE SAND TO THE PIECE OF WOOD. MAKE THE HOLE NEAT AND SMALL.

16. PACK DOWN SAND AROUND THE HOLE YOU JUST CUT.
17. IF YOU NEED MORE PRACTICE THAN DO STEPS 8 TO 16 AGAIN.
18. CLEAN UP AND PUT THINGS AWAY.
19. CHECK WITH INSTRUCTOR FOR THE DAY THAT YOU ARE TO CAST. STEPS 20 TO 26 ARE DONE THE DAY YOU CAST.
20. USE YOUR STYROFOAM IN PLACE OF THE WOOD BLOCK AND FOLLOW STEPS 8 TO 18.
21. MAKE SURE THE STYROFOAM CAN BE SEEN AT THE BOTTOM OF THE SPRUE HOLE.
22. MAKE SURE THERE IS NO LOOSE SAND IN THE SPRUE HOLE.
23. PUT THE TIN CAN IN THE POURING AREA, CLEAN UP THE SPILLED SAND AND RIDDLE, USING SMALL MESH, BACK INTO THE SAND BIN.
24. THE ALUMINUM TAKES ABOUT 1 1/2 HOURS TO MELT. IT MELTS AT 1280° F., SO THE INSTRUCTOR WILL HAVE THE FURNACE ON AND TAKE CARE OF THE MELTING AND POURING OF THE METAL.
25. BLOW OFF TOP OF CAN WITH BELLOWS.
26. HAVE LIQUID METAL (ALUMINUM) POURED INTO THE TIN CAN. INSTRUCTOR MELTS METAL.
27. LET COOL NO LESS THAN 5 MINUTES. DO NOT TOUCH.
28. DUMP OUT THE SAND AND CASTING INTO SAND BIN. USE ASBESTOS GLOVES. PUT CASTING IN COOLING AREA TO COOL. DO NOT TOUCH. USE TONGS TO PICK UP CASTING FROM BIN.
29. NEXT DAY, CUT OFF THE SPRUE WITH A HACK SAW AND PUT THE SPRUE IN MARKED TIN CAN BY THE FURNACE.
30. TAKE A CURVED-TOOTH FILE AND FILE THE CUTTING MARKS. KEEP FILE CLEAN WITH A FILE CARD. DO NOT FILE THE REST OF THE CASTING.
31. CLEAN CASTING WITH A WIRE BRUSH, SOAP AND WATER AT THE SINK.

TITLE: TIN CAN LAMP

COST:

SKETCH:



MATERIAL:

TIN CAN

OXYGEN AND ACETYLENE

TOOLS & EQUIPMENT: OXY-ACETYLENE TORCH, PLIERS

PROCEDURES:	REFERENCES:
1. OBTAIN DESIRED SIZE CAN. 2. MARK DESIGN ONTO THE CAN WITH A PENCIL OR FELT TIP MARKER. 3. USE A "00" TIP SIZE ON THE OXY-ACETYLENE WELDER WHEN BURNING OUT YOUR DESIGN. 4. LIGHT TORCH, ADJUST FLAME, AND FOLLOW YOUR DESIGN. 5. AFTER YOU ARE THROUGH BURNING YOUR DESIGN, TAKE PLIERS AND PLACE YOUR CAN IN THE SINK AND COOL WITH WATER. 6. TO EXPAND THE SIDES PRESS DOWN ON THE TOP TO PUSH THE SIDES OUT. 7. USE AS CANDLE HOLDER, LAMP OR ANYTHING YOUR IMAGINATION LEADS YOU TO.	

TITLE: ONE PIECE CASTING

COST: ______

MATERIAL:
ALUMINUM

SKETCH:

SKETCH PATTERN OF YOUR CHOICE

TOOLS & EQUIPMENT: PATTERN, FURNACE, FLASK, SAND, SHOVEL, RIDDLE, RAMMER, SPOONS AND SLICK, SPRUE AND RISER PINS, BELLOWS, STRIKE OFF BAR, PARTING COMPOUND, MOLDING BOARD, BOTTOM BOARD

PROCEDURES:	REFERENCES:
1. SELECT PATTERN. 2. FOLLOW PROCEDURE FOR MOLDING ONE PIECE PATTERN. 3. TAKE CASTING OUT OF SAND. 4. CUT OFF RISER, SPRUE AND GATES. 5. FILE SMOOTH, WHERE GATE WAS CUT OFF. 6. CLEAN CASTING.	

INFORMATION SHEET

PROCEDURE FOR MOLDING ONE PIECE PATTERN

1. WORK UP SAND WITH SHOVEL.
2. SELECT FLASK AND SET IN POSITION ON SAND BOX.
3. PLACE PATTERN FACE UP ON MOLDING BOARD, INSIDE DRAG SECTION OF FLASK (SPRINKLE PATTERN WITH PARTING COMP).
4. RIDDLE SAND OVER PATTERN, UNTIL PATTERN IS COVERED BY 1/4" OF SAND.
5. PACK SAND AROUND MOLD AND AROUND SIDES OF FLASK WITH FINGERS.
6. ADD ONE SHOVEL FULL OF SAND TO FLASK. USING A RAMMER RAM EDGES, THEN THE MIDDLE OF FLASK. REPEAT ABOVE PROCESS UNTIL FLASK IS FULL.
7. USING A STRIKE OFF BAR LEVEL TOP OF FLASK EVEN WITH SIDES.
8. WITH THE HELP OF A FRIEND, PLACE BOTTOM BOARD ON TOP OF FLASK, AND TURN FLASK OVER HOLDING BOTH BOARDS. (BE CAREFUL NOT TO DROP FLASK).
9. REMOVE MOLDING BOARD FROM TOP.
10. SPRINKLE PARTING COMPOUND OVER ENTIRE MOLD.
11. PUT TOP HALF (COPE) OF FLASK ON, MAKING SURE IT SEATS PROPERLY ON BOTTOM HALF.
12. PUSH SPRUE AND RISER PINS IN PLACE (1" INTO SAND).
13. RAM UP COPE SIDE FOLLOWING STEPS 4 THROUGH 7.
14. REMOVE COPE HALF OF FLASK. BY LIFTING STRAIGHT UP, SET FLASK ON ITS SIDE, NOT ON ITS BOTTOM. REMOVE SPRUE AND RISER PINS.
15. CUT GATES AND RUNNERS FROM SPRUE AND RISER HOLE TO PATTERN.
16. CLEAN UP BOTTOM OF SPRUE AND RISER HOLE BY PRESSING LOOSE SAND DOWN FIRMLY WITH FINGERS.
17. TO REMOVE PATTERN FROM SAND, SCREW DRAW SPIKE INTO THE PATTERN, TAP THE SPIKE GENTLY FROM SIDE TO SIDE, LIFT THE PATTERN STRAIGHT UP (BE CAREFUL).
18. SET COPE GENTLY BACK ON DRAG.
19. MOLD IS NOW READY TO POUR. SEE INSTRUCTOR FOR USE OF FURNACE.
20. PUT ALL TOOLS AWAY AND CLEAN UP AREA AROUND SAND BOX.

INFORMATION SHEET

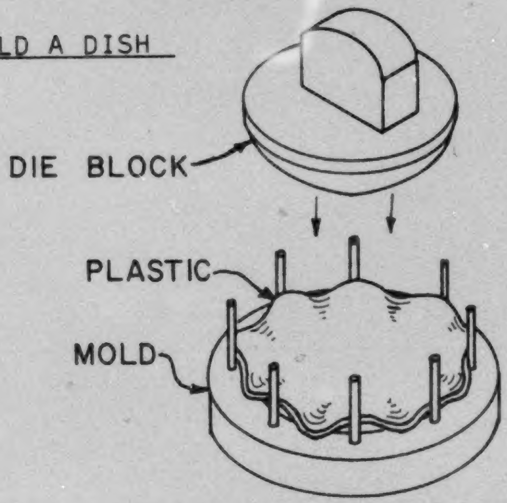
PROCEDURE FOR MOLDING A SPLIT PATTERN

1. WORK SAND WITH SHOVEL.
2. PLACE ONE-HALF OF PATTERN FLAT SIDE DOWN IN MIDDLE OF MOLDING BOARD.
3. PLACE DRAG, PINS DOWN OVER MOLDING BOARD.
4. SPRINKLE PARTING POWDER ON PATTERN AND MOLDING BOARD.
5. RIDDLE SAND OVER PATTERN, UNTIL PATTERN IS COVERED BY 1/4" OF SAND.
6. PACK SAND AROUND PATTERN WITH FINGERS.
7. FINISH FILLING DRAG WITH SAND AND RAM SAND DOWN.
8. WHEN DRAG IS RAMMED FULL, USE STRIKE OFF BAR TO LEVEL TOP.
9. PLACE BOTTOM BOARD ON TOP OF DRAG AND WITH THE HELP OF A FRIEND, TURN DRAG OVER. PINS UP.
10. REMOVE MOLDING BOARD.
11. PLACE COPE ON DRAG AND PUT SECOND HALF OF PATTERN IN PLACE.
12. SPRINKLE PARTING POWDER ON PATTERN.
13. PUSH SPRUE AND RISER PINS IN SAND 1" DEEP, APPROXIMATELY 1" AWAY FROM MOLD.
14. REPEAT STEPS 5 THROUGH 8.
15. CAREFULLY REMOVE THE COPE FROM THE DRAG AND PLACE IT ON ITS SIDE AND OUT OF THE WAY.
16. REMOVE THE SPRUE AND RISER PINS.
17. CUT A GATE FROM THE SPRUE AND RISER HOLE TO THE PATTERN. SMOOTH THE SURFACE WITH YOUR FINGER.
18. INSERT A DRAW SPIKE INTO THE PATTERN. TAP THE SCREW LIGHTLY TO LOOSEN THE PATTERN.
19. CAREFULLY LIFT THE PATTERN FROM THE BOARD.
20. REMOVE ANY LOOSE SAND FROM THE MOLD WITH THE BELLOWS.
21. REPLACE COPE ON DRAG, GENTLY.
22. PLACE FLASK IN POURING AREA. SEE INSTRUCTOR.

TITLE: PRESS MOLD A DISH

COST: ____________

SKETCH:



MATERIAL:

ACRYLIC PLASTIC 1/8" X 5" X 5"

TOOLS & EQUIPMENT: SCROLL SAW, BAND SAW, BUFFER, WET & DRY SANDPAPER, CIRCLE COMPASS, STATIONARY SANDER, GLOVES, OVEN, RULE, JIG

PROCEDURES:

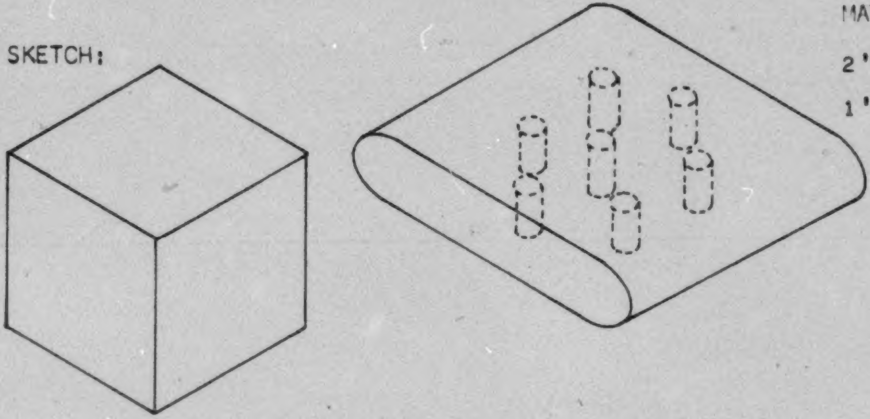
1. SELECT COLOR OF ACRYLIC PLASTIC SHEET (DO NOT REMOVE PAPER).
2. CUT 5" X 5" SQUARE FROM SHEET THAT CONSERVES ON MATERIAL ON SCROLL OR BAND SAW (DO NOT REMOVE PAPER).
3. DRAW DIAGONAL LINES CORNER TO CORNER TO LOCATE CENTER.
4. DRAW 5-INCH CIRCLE WITH COMPASS.
5. CUT OUT DISH BLANK WITH EITHER SCROLL SAW OR BAND SAW. CUT A LITTLE OUTSIDE OF LINE.
6. SAND EDGE ON BELT SANDER TO THE LINE.
7. SAND EDGE WITH WET AND DRY EMERY PAPER, USING WATER.
8. BUFF EDGE ON BUFFER.
9. REMOVE ADHESIVE PAPER AND PLACE IN OVEN AT 325°. LET HEAT FOR ABOUT 7 TO 10 MINUTES.
10. READY THE MOLD AND DIE BLOCK.
11. PUT ON ASBESTOS GLOVES AND REMOVE PLASTIC.
12. CENTER PLASTIC OVER MOLD AND PRESS DIE BLOCK AGAINST PLASTIC INTO THE MOLD.
13. LET COOL FOR 5 MINUTES BEFORE TRYING TO REMOVE.

REFERENCES:

TITLE: MEMORY CUBE (ACRYLIC)

COST: ______

SKETCH:



MATERIAL:

2" X 2" PLASTIC CUBE, OR
1" X 1" PLASTIC CUBE

TOOLS & EQUIPMENT: OVEN, DRILL PRESS, TWIST DRILL 1/16, SANDPAPER (WET & DRY) 240-400, 1/16 WELDING ROD, COLORED LAMINATING CEMENT, PLIERS, BENCH BISE

PROCEDURES:

1. CUT CUBE TO SIZE.
2. HEAT IN OVEN. SEE NOTE.
3. FLATTEN IN A VISE (SMOOTH SURFACE) TO ABOUT 1/3 THICKNESS. LET COOL IN VISE. PICK UP ACRYLIC WITH PLIERS.
4. LAY OUT AND DRILL 1/16 HOLES IN BOTTOM SIDE. DO NOT DRILL THROUGH.
5. USING 1/16 WELDING ROD, DIP AND PUSH COLORED LAMINATING CEMENT INTO HOLES.
6. HEAT IN OVEN (SEE NOTE). WATCH AND TAKE FROM OVEN WHEN IT REACHES DESIRED SHAPE. A SMALL CUBE WILL RESHAPE FASTER THAN A LARGE CUBE.
7. SAND, WET SAND, AND BUFF.

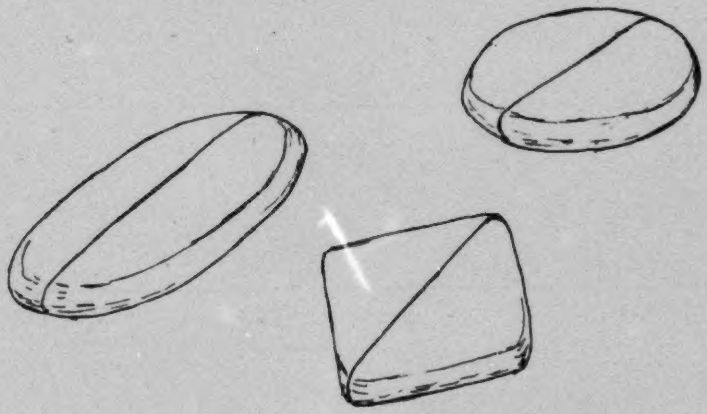
NOTE: 2" X 2" CUBES 325° FOR 30 MINUTES
1" X 1" CUBES 325° FOR 15 MINUTES

REFERENCES:

TITLE: VINYL DISPERSION

COST: ________

SKETCH:



MATERIAL:

VINYL DISPERSION MATERIAL

TOOLS & EQUIPMENT: OVEN, COIN PURSE MOLD

PROCEDURES:

1. TURN OVEN ON TO 400° AND ALLOW 5 MINUTES TO WARM UP.
2. SET TIMER FOR 15 MINUTES, THEN PRE-HEAT THE COIN PURSE MOLD AT 400°.
3. REMOVE AFTER 15 MINUTES USING GLOVES AND PLIERS AND DIP IMMEDIATELY IN THE VINYL PLASTISOL.
4. BE CAREFUL NOT TO TOUCH THE BOTTOM OR SIDES OF THE CAN AS THIS WOULD MAR THE SURFACE.
5. THE LENGTH OF TIME YOUR HOT MOLD IS LEFT IN THE PLASTISOL WILL DETERMINE YOUR WALL THICKNESS. A DIPPING OF 90 SECONDS WILL GIVE YOU A WALL THICKNESS OF 1/8".
6. REPLACE MOLD IN OVEN AFTER DIPPING FOR 15 MINUTES AT 400°. BE CAREFUL NOT TO MAR THE SURFACE.
7. REMOVE FROM CURING OVEN AND COOL IN WATER FROM 2 - 5 MINUTES.
8. CUT THE COIN CASE AND SLIP OFF THE FORM. TRIM OFF EXCESS PLASTIC, THEN PUNCH A HOLE IN THE END OPPOSITE THE WIRE WITH A LEATHER PUNCH. PUNCH 2 HOLES FOR THE KEY CHAIN.
9. RETURN MOLDS, MATERIAL AND SUPPLIES TO THEIR PROPER PLACE. DON'T FORGET TO UPDATE YOUR PERFORMANCE AND EXPENSE SHEET.

REFERENCES:

TITLE: HOW TO MAKE A CASTING

COST: ______

SKETCH:

SKETCH YOUR MOLD

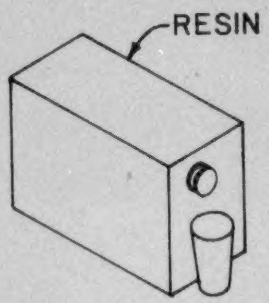
MATERIAL:
MOLD
CASTING RESIN
CATALYST
DYES

TOOLS & EQUIPMENT: ______

PROCEDURES:

1. SELECT OR MAKE A MOLD.
2. IF YOU MAKE A MOLD, YOU CAN SHAPE IT OVER A WOODEN SHAPE, PLASTER SHAPE, OR SOME CASTING BY VACUUM FORMING OVER IT WITH POLYETHYLENE SHEET. REFER TO VACUUM FORMING INSTRUCTION SHEET.
3. CLEAN MOLD.
4. FILL MOLD WITH WATER AND POUR INTO CUP TO SEE HOW MUCH RESIN IS NEEDED. DRY THE MOLD.
5. SELECT DYE COLORS.
6. POUR AMOUNT OF CASTING RESIN NEEDED INTO CUP OR CUPS. POUR WITH SPOUT OF GALLON CONTAINER UP, CLEAN SPOUT BEFORE REPLACING LID.
7. ADD DYE COLOR.
8. ADD 4 DROPS OF CATALYST TO EACH OUNCE OF RESIN. NO MORE - IF TOO MUCH IS ADDED, IT WILL BURN UP MOLD.
9. STIR THOROUGHLY.
10. POUR INTO MOLD.
11. LET SET OVERNIGHT BEFORE REMOVING.
12. BREAK OUT OF MOLD AND CLEAN MOLD FOR THE NEXT GUY.
13. EVERY CASTING MADE MUST BE MOUNTED OR FIXED IN SOME WAY FOR DISPLAY OR USE.

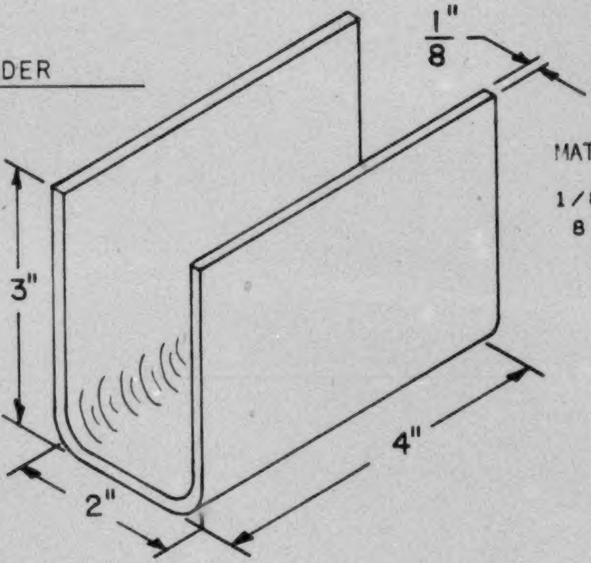
REFERENCES:



TITLE: NAPKIN HOLDER

COST: ________

SKETCH:



MATERIAL:

1/8" ACRYLIC PLASTIC 4" WIDE,
8" LONG

TOOLS & EQUIPMENT: SCRIBE, TRY SQUARE, STRIP HEATER, SCROLL SAW, COPING SAW

PROCEDURES:

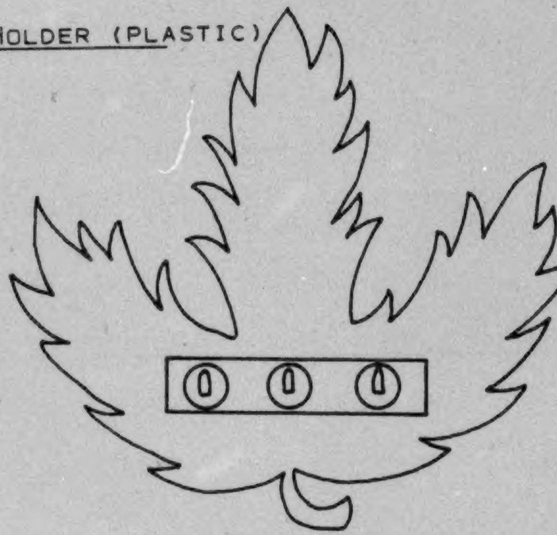
1. CUT OUT A PIECE OF 1/8" ACRYLIC PLASTIC 4" WIDE AND 8" LONG, USING A COPING SAW OR BACK SAW, OR SCROLL SAW.
2. SAND EDGES SMOOTH BY USING A 240, 400 GRIT ABRASIVE PAPER.
3. POLISH EACH EDGE ON THE BUFFING MACHINE BEING CAREFUL NOT TO BURN THE EDGE.
4. ALONG EACH 8" SIDE SCRIBE A LIGHT MARK 3" IN FROM EACH OUTSIDE EDGE. THIS WILL BE YOUR FOLD MARK.
5. YOU ARE NOW READY TO REMOVE THE PROTECTIVE PAPER FROM THE ACRYLIC PLASTIC. LAY THE FLAT 4 X 8 PIECE ACROSS THE STRIP HEATER ELEMENTS MAKING SURE IT IS SQUARE AND MATCHES THE SCRIBE MARKS YOU PLACED ALONG THE 8" EDGE.
6. ALLOW THE STRIP HEATER TO WARM UP, THEN PLACE YOUR PLASTIC ON THE STRIP HEATER.
7. OBSERVE THE PLASTIC. YOU WILL NOTICE THAT THE HEAT FROM THE ELEMENT SOFTENS THE MATERIAL AND YOU WILL SEE TWO LINES TOWARDS THE OUTSIDE EDGES OF THE HEATED AREA. THE MATERIAL IS NOW READY TO BEND.
8. REMOVE FROM HEATER AND USING A TRY SQUARE AS A GUIDE, BEND EDGE TO A 90° ANGLE. BE CAREFUL NOT TO TOUCH THE HOT SURFACE, AS THIS WILL MARK THE SURFACE. REPEAT THIS PROCEDURE TO MAKE OTHER ANGLE. TURN OFF STRIP HEATER.
9. CONGRATULATIONS! YOU HAVE NOW COMPLETED A HANDY NAPKIN HOLDER.

REFERENCES:

TITLE: HOT PAD HOLDER (PLASTIC)

COST: ____________

SKETCH:



MATERIAL:

PLEXIGLASS 1/16 TO 1/8

CUP HOOKS

PLASTIC GLUE

LAMINATING CEMENT

TOOLS & EQUIPMENT: SCROLL SAW (FINE TOOTH FOR SMOOTHER EDGES), DRILL & BIT (DRILL PRESS OR HAND DRILL), FILE (FINE TOOTH), SANDPAPER (MEDIUM & FINE), BUFFER & PLASTIC BUFFING COMPOUND

PROCEDURES:

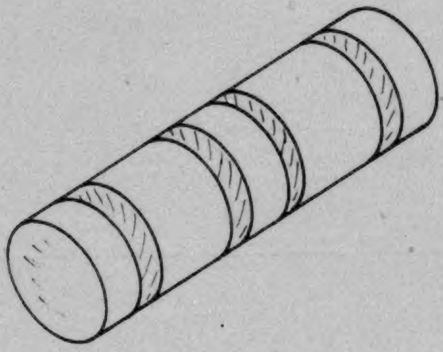
1. DRAW PATTERN (OR YOUR OWN DESIGN) ON BACKING PAPER OF PLASTIC.
2. CUT OUT LEAF (OR OTHER DESIGN) WITH SCROLL SAW.
3. CUT OUT PLASTIC BASE FOR CUP HOOKS (APPROX. 5/8" X 3").
4. FILE AND/OR SAND EDGE OF CUP HOOK BASE (NOT NECESSARY TO POLISH EDGE OF LEAF).
5. BUFF EDGE OF BASE.
6. LOCATE AND GLUE BASE TO LEAF.
7. DRILL HOLE FOR HANGING LEAF (ABOUT 5/32") AND CUP HOOKS. ETHELENE DICHOLRIDE CAN SOFTEN PLASTIC TO SCREW IN CUP HOOKS EASIER.

REFERENCES:

TITLE: COLOR LAMINATING

COST: ________

SKETCH:



MATERIAL:

1/4, 1/8 OR 1/2" CLEAR ACRYLIC PLASTIC

COLORED LAMINATING CEMENT

FINDINGS

TOOLS & EQUIPMENT: SCROLL SAW, 240, 400 ABRASIVE PAPER, BUFFER, DRILL PRESS, FLEXIBLE SHAFT

PROCEDURES:	REFERENCES:
1. CUT DESIRED NUMBER OF ACRYLIC PIECES FROM EDGE OF SCRAP ACRYLIC.	
2. CEMENT PIECES TOGETHER USING COLORED LAMINATING CEMENT.	
3. SHAPE USING BELT SANDER, FILES, AND FLEXIBLE SHAFT (INSTRUCTOR HAS BURR FOR FLEXIBLE SHAFT).	
4. SAND SMOOTH BY USING A 240, 400 GRIT ABRASIVE PAPER.	
5. POLISH ON BUFFER.	
6. DRILL HOLE FOR HARDWARE ON DRILL PRESS.	

TITLE SCREWDRIVER

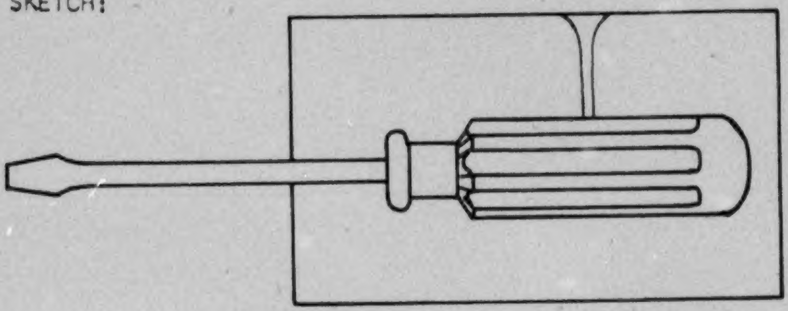
COST: ____________

MATERIAL:

4" x 1/8" DRILL ROD

P-400 POLYSTYRENE

SKETCH:



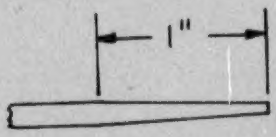
TOOLS & EQUIPMENT: MILL FILE, BALL PEEN HAMMER, SCREWDRIVER HANDLE DIE, INJECTION MOLDER, EMERY CLOTH, BENCH FURNACE

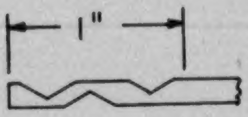
PROCEDURES:

1. OBTAIN A 4" PIECE OF 1/8" DRILL ROD.
2. HAMMER ONE END TO THE TAPER OF A SCREWDRIVER BLADE WITH A MEDIUM WEIGHT BALL PEEN HAMMER. THIS SHOULD BE ABOUT A 1" TAPER.
3. FILE THE SIDES OF THIS TAPER TO THE BLADE SHAPE OF A SCREWDRIVER.
4. FILE TAPER TO RIGHT THICKNESS USING A MILL FILE.
5. NOTCH AND FLATTEN HANDLE END FOR ABOUT AN INCH, SO THAT BLADE WILL GRIP INTO PLASTIC HANDLE.
6. HARDEN AND TEMPER TO A PALE BLUE (590°) USING BENCH FURNACE.
7. POLISH WITH FINE EMERY CLOTH.
8. PLACE BLADE IN GROOVE OF MOLD.
9. CLOSE MOLD AND PLACE IN MACHINE WITH CENTER SPRUE HOLE UNDER NOZZLE AND CLAMP HAND TIGHT.
10. INJECT PLASTIC.
11. PART MOLD.
12. HOLDING BLADE, LIFT SCREWDRIVER OUT OF CAVITY.

REMEMBER, HANDLE ALL PARTS CAREFULLY. THIS IS A FINE PRECISION MOLD. DO NOT SCRATCH, NICK OR DROP. DO NOT FORGET TO UPDATE YOUR PERFORMANCE RECORD SHEET.

REFERENCES:





TITLE: VACUUM FORMING COST: ____

MATERIAL:
10" X 12" SHEET PLASTIC

SKETCH:

SEE EXAMPLES IN PLASTICS AREA

1. NAME PLATE OR SIGN
2. FORMING FROM PATTERNS
3. SKIN PACKAGING
4. BLISTER PACKAGING
5. MAKING PATTERNS FROM PATTERNS
   A. AQUA ZAP MOLDS
   B. MOLDS FOR FOUNDRY WORK IN HOT METALS

TOOLS & EQUIPMENT: VACUUM FORMER, BUFFER, FILES, ABRASIVE PAPER, OBJECT TO BE DUPLICATED

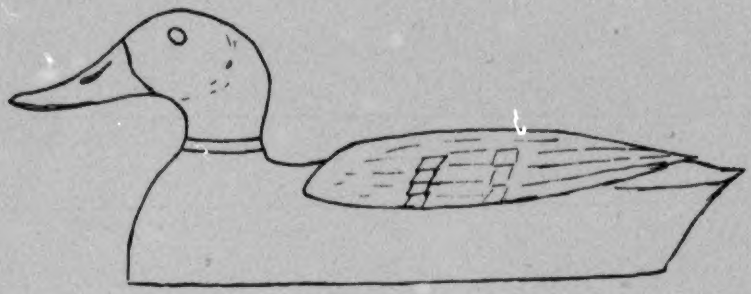
PROCEDURES:	REFERENCES:
1. SELECT A PATTERN OR OBJECT YOU WISH TO VACUUM FORM. SEE INSTRUCTION SHEET. 2. GET CHECKED OUT ON VACUUM FORMER. 3. SELECT THE RIGHT PLASTIC SHEET FOR YOUR PROJECT. 4. VACUUM FORM YOUR ITEM. 5. CUT, SHAPE AND PAINT AND FINISH AS DESIRED. 6. MOUNT OR DISPLAY YOUR ITEM AS DESIRED. 7. EVALUATE YOUR WORK.	

TITLE: PROCEDURE FOR MAKING DUCK DECOY
WITH EXPANDABLE STYRENE

COST: ________

MATERIAL:
EXPANDABLE STYRENE BEADS

SKETCH:



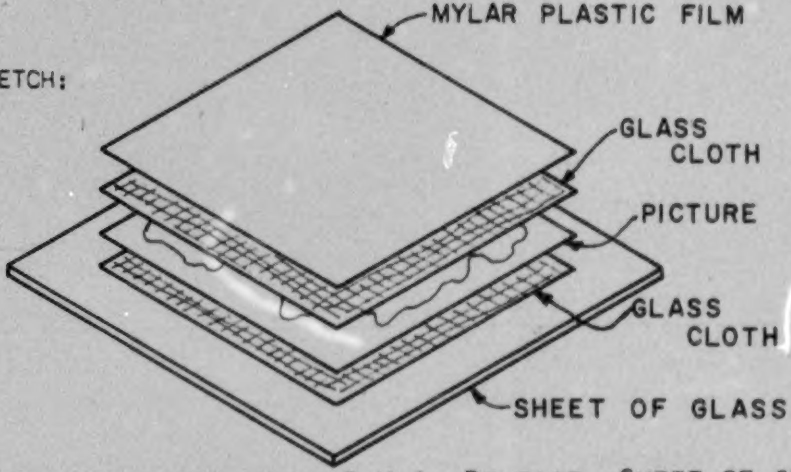
TOOLS & EQUIPMENT: OVEN, PREPARED DUCK MOLD, LENGTH OF 1/2" DOWEL 5" LONG

PROCEDURES:	REFERENCES:
1. TURN OVEN ON TO 400°.	
2. BOIL 4" OF WATER IN A PAN AND PRE-EXPAND THE VIRGIN BEADS.	
3. PLACE 10 SERVING SPOONS OF BEADS IN BOILING WATER AND SKIM OFF AS THEY RISE TO THE TOP.	
4. PACK THE MOLD FULL OF PRE-EXPANDED BEADS.	
5. SET TIMER ON STOVE FOR 20 MINUTES, THEN PLACE DUCK BODY IN OVEN.	
6. REMOVE BODY AFTER 20 MINUTES USING THE GLOVES PROVIDED ABOVE THE STOVE AND COOL MOLD BY ALLOWING WATER TO RUN OVER THE MOLD. REMEMBER THE DUCK BODY IS THICK IN THE MIDDLE AND SHOULD BE COOLED FOR 2 - 5 MINUTES.	
7. FILE THE PARTING LINE OF DECOY IF NECESSARY.	
8. DRILL 1/2" HOLE FOR HEAD PIN THROUGH BODY IN THE CENTER OF IMPRESSION MADE BY FILLER PLUG.	
9. THE BODY IS NOW READY FOR PAINT. REMEMBER LACQUER BASED PAINTS CANNOT BE USED.	
PREPARING THE HEAD	
1. BOLT THE TWO HALVES OF THE CASTING TOGETHER AND FILL WITH UN-EXPANDED BEADS THROUGH THE HOLE IN THE NECK.	
2. INSERT THE 1/2" DOWEL IN THE HOLE WITH NOTCHES FIRST UNTIL IT HITS THE TOP OF THE CASTING AND THEN PULL IT BACK 1/2".	
3. PLACE IN OVEN WITH DUCK BODY FOR 20 MINUTES.	
4. REMOVE FROM OVEN AND COOL COMPLETELY.	
5. REMOVE BOLTS. HEAD NOW READY TO INSTALL ON BODY.	
6. CLEAN UP THE AREA, RETURN MOLDS, MATERIALS AND SUPPLIES TO THEIR PROPER PLACE.	

TITLE: LAMINATE A PICTURE

COST: ________

SKETCH:



MATERIAL:
POLYESTER LAMINATING RESIN
PICTURE
2 FIBERGLASS CLOTHS
CATALYST

TOOLS & EQUIPMENT: WAX, P.V.A. RELEASE, SHEET OF GLASS LARGER THAN PICTURE, SCISSORS, BRAYER, PAINT BRUSH, MYLAR FILM, CUP, STIR STICK, ACETONE

PROCEDURES:	REFERENCES:

1. SELECT PICTURE WHICH IS FREE OF PRINT ON BACK SIDE, SHOULD NOT BE MORE THAN 12" SQUARE.
2. CUT TWO PIECES OF FIBERGLASS CLOTH, WITH SCISSORS, 1" LARGER AND WIDER THAN PICTURE.
3. CUT SHEET OF GLASS 2" LONGER AND 2" WIDER THAN PICTURE.
4. CUT MYLAR LARGER THAN GLASS.
5. OBSERVE FILM LOOPS.
6. LAY UP PICTURE - WEAR EYE PROTECTION.
   A. WAX GLASS AND POLISH.
   B. COAT OVER WAX WITH FIBER RELEASE P.V.A. USE BRUSH AND COAT THIN, LET DRY 30 MINUTES. CLEAN BRUSH IN WATER.
   C. POUR 3 OZ. LAMINATING RESIN INTO PAPER CUP. USE MEASURE, ABOUT 1/2 CUP.
   D. ADD 18 DROPS OF CATALYST AND MIX THOROUGHLY.
   E. LAY GLASS ON SEVERAL SHEETS OF NEWSPAPER.
   F. BRUSH THIN COAT OF MIXED RESIN ON GLASS.
   G. LAY FIBERGLASS CLOTH INTO RESIN AND SATURATE WITH RESIN. DAB WITH END OF BRUSH.
   H. LAY PICTURE FACE UP INTO RESIN AND COAT WITH RESIN.
   I. LAY FIBERGLASS CLOTH INTO RESIN AND SATURATE WITH REST OF CATALYZED RESIN. DAB WITH END OF BRUSH TO GET OUT BUBBLES.
   J. COVER WITH MYLAR PLASTIC FILM.

LAMINATE A PICTURE (CON'T)

K. ROLL OUT AIR BUBBLES USING BRAYER.

L. PUT SOME WEIGHT ON MYLAR TO HOLD IT DOWN IF NECESSARY.

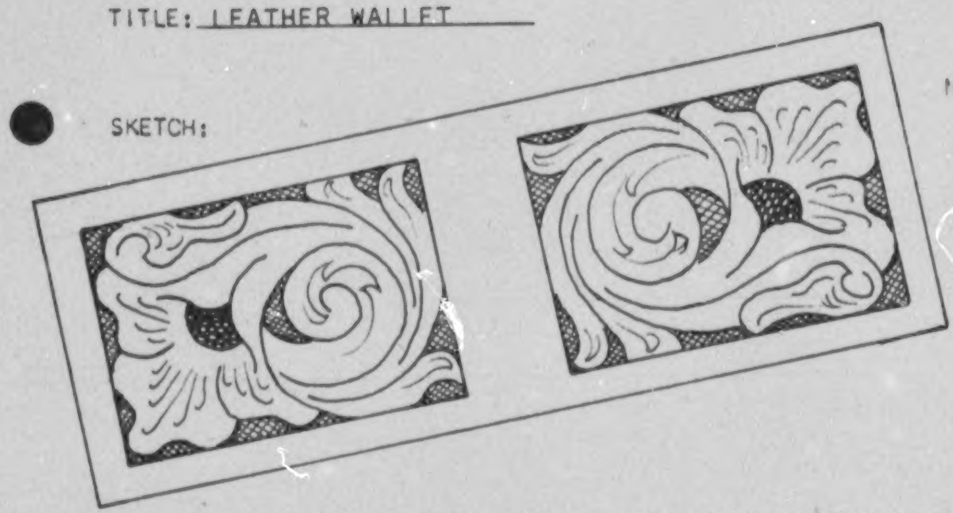
M. SET IN STORAGE TO SET UP. OVERNIGHT NECESSARY.

7. CLEAN BRUSH. GIVE BRUSH TO INSTRUCTOR.
8. PEEL OF MYLAR THE NEXT DAY.
9. PEEL FROM GLASS.
10. CLEAN GLASS FOR REUSE.
11. TRIM TO SIZE ON SQUARING SHEAR.
12. FRAME WITH WOOD IF DESIRED.

TITLE: LEATHER WALLET

COST: ____________

SKETCH:



MATERIAL:

4-5 OZ. LEATHER
LACE
WALLET INSIDE
NEEDLE

TOOLS & EQUIPMENT: SWIVEL KNIFE, STAMPING TOOLS, THONGING PUNCH, MALLET, DIVIDERS, AVIATION SNIPS

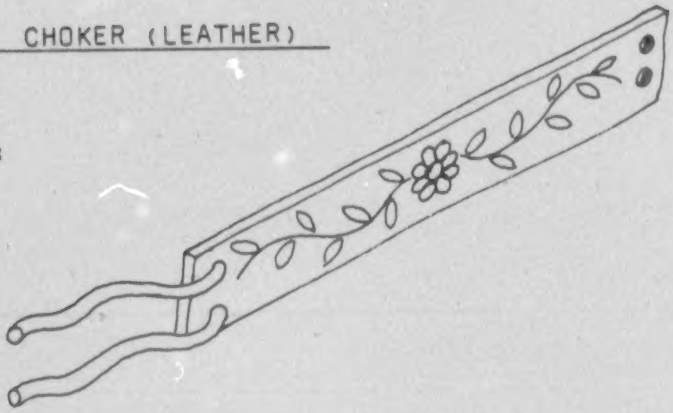
PROCEDURES:	REFERENCES:

1. DRAW 1 RECTANGLE 3 3/8" X 9" ON A PIECE OF PAPER AND HAVE A 1/4" BORDER LINE ON BOTH SIDES.
2. DRAW 1 FLOWER DESIGN INSIDE OF THE BORDER LINES. LET THE DESIGN TOUCH ALL FOUR BORDER LINES.
3. DAMPEN LEATHER ON BOTH SIDES. CENTER AND TRACE PATTERN ON THE GRAIN SIDE.
4. CARVE DESIGN WITH SWIVEL KNIFE, HOLD SWIVEL KNIFE AT 45° ANGLE, FRONT AND BACK AND PERPENDICULAR SIDEWAYS TO THE LEATHER. CUT ALL LINES, DESIGN AND BORDER (USE MARBLE SLAB FOR STAMPING).
5. STAMP THE DESIGN USING THE STAMPING TOOLS IN THE FOLLOWING ORDER: 1. BEVEL 2. CAMOUFLAGE 3. VEINER OR SHELL 4. SHADER 5. SEEDER 6. BACKGROUND 7. DRESS CUTS.
6. SET DIVIDERS AT 1/8" AND SCRIBE A LINE AROUND THE EDGE OF THE WALLET.
7. USE EITHER A THONGING CHISEL OR THONGING PUNCH TO PUNCH THE LACING HOLES, ALONG THE 1/8" SCRIBE LINES.
8. LINE UP THE WALLET INSIDE WITH THE OUTSIDE AND PUNCH LACING HOLES TO MATCH.
9. CLEAN WITH LEATHER BLEACH. LET DRY OVERNIGHT.
10. APPLY ONE COAT OF NEAT-LAC.
11. LACE THE WALLET.

TITLE: CHOKER (LEATHER)

COST: ________

SKETCH:



MATERIAL:

LEATHER

TAN KOTE

LACE (FOR TIES)

LEATHER BLEACH

LACE (FOR EDGES)

TOOLS & EQUIPMENT: SCISSORS, TIN SNIPS, SQUARING SHEARS, LEATHER STAMPING TOOLS, MALLET, BRUSH, SWIVEL KNIFE, REVOLVING PUNCH, PENCIL, WOOD (TO CUT ON)

PROCEDURES:

1. CUT A PIECE OF PAPER THE EXACT SIZE OF YOUR FINISHED LEATHER CHOKER. DRAW A BORDER AND/OR DESIGN ON THE PAPER. MARK THE HOLES REQUIRED.
2. FIGURE YOUR COST AND RECORD IN YOUR NOTEBOOK ON THE EXPENSE.
3. CUT LEATHER FROM EDGE OF LARGE PIECE. USE DRAW GAUGE FOR LONG STRAIGHT CUTS.
4. DAMPEN LEATHER, LAY DESIGN ON LEATHER AND TRACE OVER IT WITH A PENCIL, SO AS TO LEAVE AN IMPRESSION. MARK ANY HOLES REQUIRED.
5. CUT LINES ON LEATHER WITH SWIVEL KNIFE.
6. BEVEL ON THE OUTSIDE EDGE WITH SWIVEL KNIFE CUTS.
7. USING STAMPING TOOLS FINISH STAMPING DESIGN. FOLLOW DIRECTIONS ON PAGES 38 TO 45 IN GENERAL LEATHERCRAFT BY CHERRY. FOLLOW THESE DIRECTIONS AND YOU WILL HAVE A DESIGN YOU CAN BE VERY PROUD OF.
8. PUNCH HOLES FOR LACE AND TIES USING A BLOCK OF WOOD TO WORK ON.
9. LACE EDGES IF DESIRED.
10. CLEAN WITH LEATHER BLEACH, WHICH IS LOCATED IN THE FINISH AREA. RUB ON WITH A PAD OF PAPER TOWEL. LET DRY OVERNIGHT. WASH HANDS THOROUGHLY WHEN FINISHED, AS LEATHER BLEACH IS A TYPE OF POISON.
11. IF YOU DO NOT LACE EDGES, DRESS EDGES WITH TAN KOTE.
12. RUB TAN KOTE ON IN FINISH AREA.

REFERENCES:

TITLE: LEATHER VISOR

COST: ________

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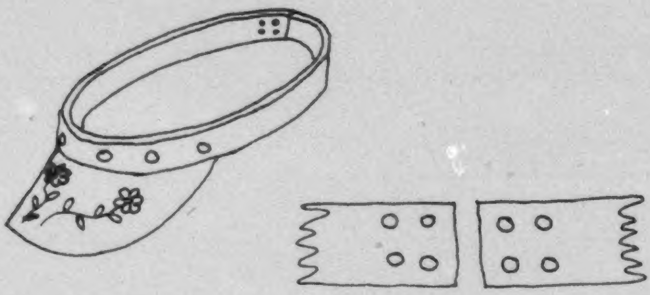


MATERIAL:
6-8 OZ. TOOLING LEATHER
5 RIVETS, SIZE MEDIUM
LACE
LEATHER DYES
ANTIQUING
TAN KOTE

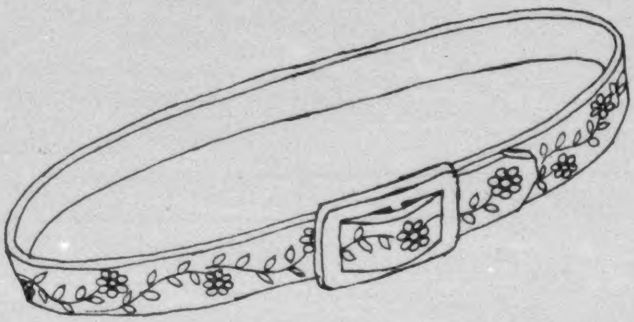
TOOLS & EQUIPMENT: LEATHER SHEAR, LEATHER PUNCH, SADDLE STAMPS, SWIVEL KNIFE (OPTIONAL), EDGE BEVELER, EDGE SLICKER

PROCEDURES:	REFERENCES:
1. LAY OUT TEMPLATE ON LEATHER (DO NOT WASTE). DRAW PATTERN. (NO BALL POINT.) 2. CUT OUT WITH LEATHER SHEAR. 3. BEVEL EDGES. 4. SLICK EDGES. 5. PUNCH RIVET HOLES. 6. CASE LEATHER. USE CLEAN SPONGE, CLOTH OR PAPER. 7. CARVE DESIGN WITH SWIVEL KNIFE. THIS IS AN OPTIONAL STEP. 8. USE APPROPRIATE SADDLE STAMPS. 9. DYE LEATHER (IT MAY BE ANTIQUED AFTER DYEING). 10. APPLY TAN KOTE OR OTHER LEATHER PRESERVATIVE. 11. RIVET VISOR TO BAND. 12. CUT BAND IN BACK TO EXACT HEAD SIZE. 13. PUNCH 4 HOLES IN THE ENDS OF EACH HEAD BAND STRAP. 14. LACE ENDS AND ADJUST TO YOUR SIZE.	

TITLE: NATURE TAN BELT

COST: ______

SKETCH:



MATERIAL:
NATURE TAN LEATHER
BELT BLANK 7-8 OZ.
DYES
BEES WAX
NEAT LAC
BELT SNAPS

TOOLS & EQUIPMENT: STAMPING TOOLS, MALLET, BRUSH, SWIVEL KNIFE, MARBLE SLAB

PROCEDURES:

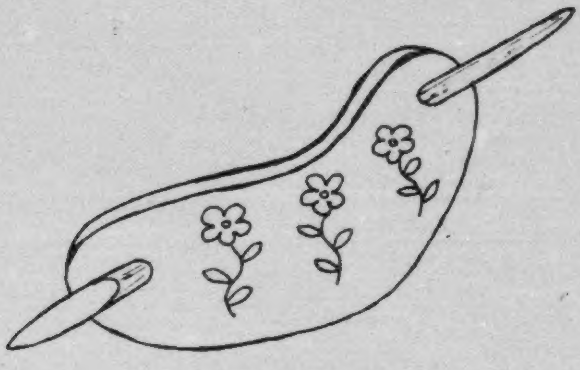
1. DAMPEN LEATHER.
2. STAMP DESIRED DESIGNS WITH STAMPING TOOLS. CUT STEMS WHERE DESIRED WITH SWIVEL KNIFE.
3. PUNCH HOLES FOR SNAPS WITH DRIVE PUNCH. PUNCH SLOT FOR BUCKLE WITH DRIVE PUNCH. INSTRUCTOR HAS THE BAG PUNCH.
4. FINISH WITH OMEGA DYE. DYES ARE IN FINISH AREA.
5. FINISH WITH COVA DYE ONLY IF DESIRED.
6. BEVEL EDGES WITH EDGE BEVELER.
7. DYE EDGES WITH DARK BROWN OR BLACK OMEGA DYE.
8. DRESS EDGES WITH BEES WAX. SLICKER BRISKLY OVER BEES WAX. ASK INSTRUCTOR FOR DEMONSTRATION.
9. BRUSH ON NEAT LAC IN FINISH AREA. WAIT UNTIL DYE DRIES OR WIPE ON CARNUBA CREAM. USE SOFT CLOTH.
10. SET SNAPS.

REFERENCES:

TITLE: LEATHER BARRETTE

COST: ________

SKETCH:



MATERIAL:

6 - 8 OZ. LEATHER

DOWEL (BIRCH)

TAN KOTE

DANISH OIL

TOOLS & EQUIPMENT: SCISSORS, AVIATION SNIPS, LEATHER STAMPING TOOLS, MALLET, WOOD (TO CUT ON), BRUSH, REVOLVING PUNCH, SAW, SANDPAPER, SWIVEL KNIFE, PENCIL, MARBLE BLOCK (TO STAMP ON)

PROCEDURES:

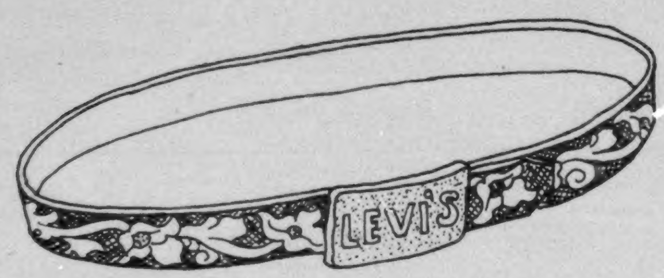
1. CUT A PIECE OF PAPER TO EXACT SIZE OF THE TEMPLATE FOR A LEATHER BARRETTE. MARK HOLES. TEMPLATE IS IN CRAFTS AREA.
2. FIGURE COST AND RECORD IN YOUR NOTEBOOK ON YOUR EXPENSE RECORD FORM.
3. CUT LEATHER FROM EDGE OF LARGER PIECE. USE AVIATION SNIPS.
4. DAMPEN LEATHER, LAY PAPER PATTERN ON LEATHER AND TRACE AROUND IT WITH LEATHER STYLUS. MARK HOLES.
5. STAMP DESIRED DESIGNS WITH STAMPING TOOLS. CUT STEMS WHERE DESIRED WITH SWIVEL KNIFE.
6. PUNCH HOLES WITH REVOLVING PUNCH.
7. FINISH WITH OMEGA DYE (DYES ARE IN FINISH AREA).
8. FINISH WITH COVA DYE ONLY IF DESIRED.
9. BEVEL EDGES WITH EDGE BEVELER.
10. DRESS EDGES WITH TAN KOTE AND SMOOTH WITH EDGE SLICKER.
11. RUB TAN KOTE IN FINISH AREA. WAIT UNTIL DYE DRIES.
12. CUT DOWEL TO LENGTH, FINISH ENDS AND SAND. (TO POINT USE PENCIL SHARPENER.)

REFERENCES:

TITLE: WESTERN CARVED BELT

COST: ______

SKETCH:



MATERIAL:

1 LEATHER BELT BLANK, 7 - 8 OZ.

NEAT LAC

BUCKLE

BEES WAX

TOOLS & EQUIPMENT: STAMPING TOOLS, MALLET, SNAP SET, ROTARY PUNCH, EDGE TOOLS, BAG PUNCH, SWIVEL KNIFE, MARBLE SLAB (TO STAMP ON)

PROCEDURES:

1. DRAW 1 RECTANGLE ON TRACING PAPER THE WIDTH OF THE BELT BLANK (MAKE DESIGN).
2. MOISTEN LEATHER, CENTER AND TRACE DESIGN ON THE GRAIN SIDE
3. CARVE DESIGN WITH SWIVEL KNIFE AND STAMP WITH STAMPING TOOLS. USE MARBLE SLAB TO STAMP ON.
4. BEVEL EDGES WITH EDGE BEVELER.
5. CLEAN WITH LEATHER BLEACH IN FINISH AREA.
6. OPTIONAL: FINISH WITH ANTIQUE.
7. ONE HALF FINISH EDGES WITH EDGE SLICKER.

[illegible]. APPLY ONE COAT OF NEAT LAC FOUND IN FINISH AREA.

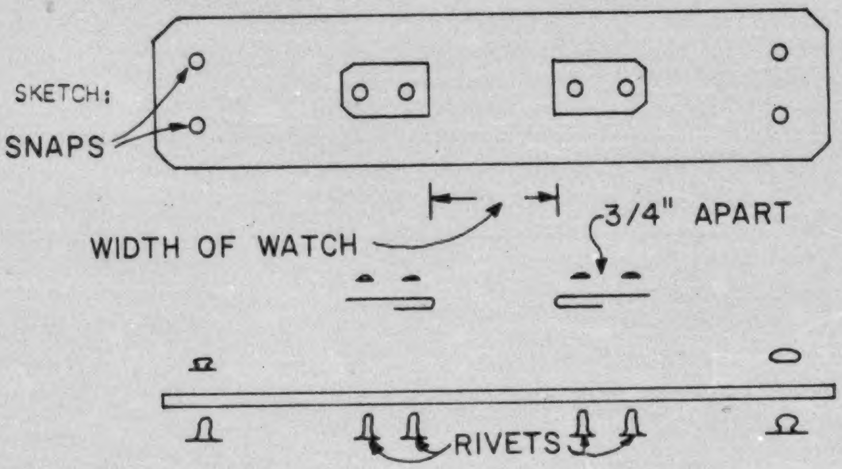
9. PUNCH HOLES FOR SNAPS. USE DRIVE PUNCH.
10. PUNCH OBLONG SLOT FOR BUCKLE (USE BAG PUNCH).
11. SET SNAPS.

REFERENCES:

TITLE: WATCH BAND

COST: ____________

SKETCH:



MATERIAL:

LEATHER, 8-9 OZ., 1 3/4" WIDE

LEATHER, 3-4 OZ., 5/8" X 5"

2 SNAPS

4 RIVETS

TOOLS & EQUIPMENT: Scissors, Edge Beveler, Edge Creasing Tool, Drive Punches, Snap Button Set, Edge Slicker

PROCEDURES:

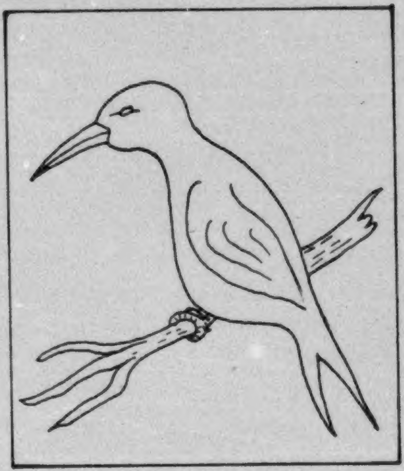
REFERENCES:

1. CUT A STRIP OF BELT LEATHER (8-9 OZ.) LONG ENOUGH TO WRAP AROUND YOUR WRIST COMFORTABLY (ALLOW 3/4" OVERLAP FOR SNAPS).
2. CLIP CORNERS ON EACH END OR ROUND AS DESIRED.
3. BEVEL ALL EDGES WITH THE EDGE BEVELER.
4. CASE LEATHER (MOISTEN THE EDGES) OF THE LEATHER WITH A DAMP PAPER TOWEL.
5. CREASE AROUND ALL EDGES WITH EDGE CREASING TOOL.
6. PUNCH HOLES ON ONE END. BE SURE THEY ARE PROPERLY PLACED. WRAP THE BAND AROUND YOUR WRIST, FIT IT SNUGLY, THEN GET A FRIEND TO MARK THE POSITION FOR THE TWO HOLES ON THE OPPOSITE END AND PUNCH.
7. FIND THE CENTER LINE ACROSS THE WATCH BAND AND MARK LIGHTLY. THEN MARK 5/8" ON EITHER SIDE OF THE CENTER LINE TO PLACE THE WATCH STRAPS.
8. MARK 1 1/8" ON EITHER SIDE OF THE CENTER LINE, MARK AND PUNCH FOR PLACEMENT OF THE FIRST RIVETS.
9. MARK 3/4" FROM EACH OF THE RIVET HOLES, THEN PUNCH FOR THE SECOND RIVET.
10. CUT AND TRIM HOLD DOWN STRAPS. PUNCH THEM TO FIT WATCH BAND.
11. AT THIS TIME DYE AND FINISH AS DESIRED.
12. SLICK EDGES USING CARNUBA CREAM AND SLICKER DISC.
13. AFTER DYING IS COMPLETE, RIVET HOLD-DOWN STRAPS TO BAND AND FASTEN SNAPS IN THE PROPER PLACES.
14. APPLY CARNUBA CREAM TO WATCH BAND AND BUFF.
15. FILL OUT AN EVALUATION FORM AND PRESENT TO YOUR INSTRUCTOR FOR FINISHING APPROVAL.

TITLE: COPPER TOOLING

COST: ________

SKETCH:



MATERIAL:
1 - 6" X 8" COPPER FOIL
DOWELS FOR MODELING
TRACING PAPER
FLAT BLACK PAINT

TOOLS & EQUIPMENT: AVIATION SNIPS, PENCIL SHARPENER (TO SHARPEN 1/4" WOOD DOWEL)

PROCEDURES:

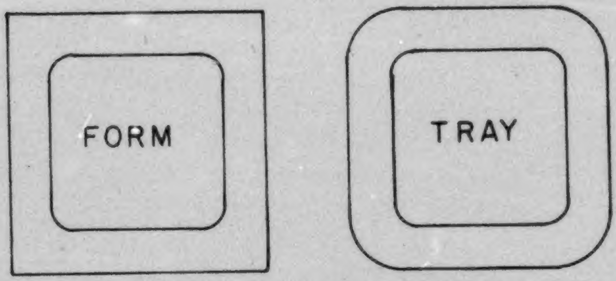
1. CUT ONE 6" X 8" PIECE OF 40 GAUGE COPPER FOIL. USE AVIATION SNIPS.
2. CUT A 1/4" WOOD DOWEL 6" LONG.
3. SHARPEN WOOD DOWEL IN THE PENCIL SHARPENER ON ONE END. BEVEL THE OPPOSITE END.
4. FOLLOW COPPER TOOLING CHART STEPS 1 THROUGH 12. (STEP 7 - USE MARBLE SLAB FOR BACKGROUND).
5. USE A MAGAZINE OR PAPER TOWEL TO MAKE A SOFT BACKGROUND TO WORK ON.
6. MOUNT PICTURE ON PLYWOOD BOARD OR FRAME.

REFERENCES:

TITLE: ART METAL BEATING DOWN A TRAY

COST: ____________

SKETCH:



MATERIAL:

3/4" X 12" X 12" PLYWOOD

20 - 24 GA. 12" X 12" ALUMINUM

4 NAILS

STEEL WOOL - FINE

ABRASIVE CLOTH - FINE

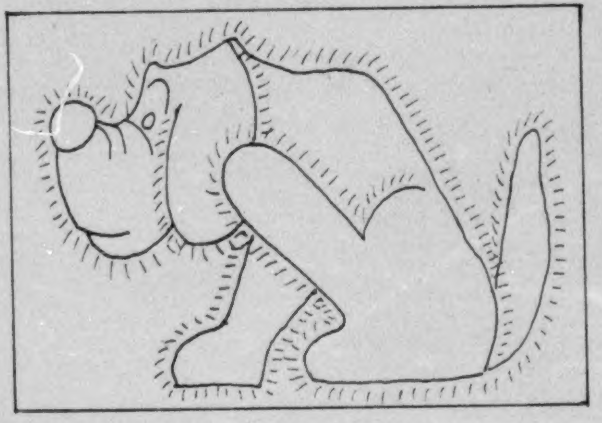
TOOLS & EQUIPMENT: FORMING HAMMER, TINNER SNIPS, SINGLE CUT FILE, BALL PEEN HAMMER, BAND SAW, JIG SAW, DRILL PRESS, SABER SAW, BUFFER

PROCEDURES:	REFERENCES:
1. DRAW THE SHAPE THAT YOU WANT YOUR TRAY, E.G., ROUND, OVAL, IRREGULAR.	
2. DRAW THE SHAPE ON THE CENTER OF THE 12" X 12" PIECE OF PLYWOOD.	
3. CUT THE TRAY SHAPE OUT OF THE CENTER OF A 3/4" PIECE OF PLYWOOD.	
4. CUT A PIECE OF 24 GAUGE ALUMINUM 12" X 12" AND DRAW THE LAYOUT LINE SHOWING THE SECTION TO BE BEATEN DOWN.	
5. NAIL THE METAL AT THE CORNERS TO THE FORM, TO HOLD IN PLACE OVER THE FORM.	
6. USE THE METAL OR WOOD FACE FORMING HAMMER. STRIKE THE METAL WITH GLANCING BLOWS INSIDE THE LAYOUT LINE AREA TO BE SUNK.	
7. AS THE METAL TAKES SHAPE, WORK TOWARDS THE CENTER IN ROWS UNTIL THE METAL IS STRETCHED TO THE BOTTOM OF THE FORM.	
8. AS YOU WORK THE METAL IT WILL BECOME HARD. THE METAL WILL REQUIRE ANNEALING.	
9. PLANISHING SMOOTHES AWAY HAMMER MARKS AND WILL GIVE A FINE FINISH TO THE METAL SURFACE.	
10. FINISH THE PROJECT BY CUTTING, FILING, AND ENRICHING THE EDGE AS DESIRED.	
11. CLEAN WITH FINE STEEL WOOL.	
12. BUFF TO THE DESIRED LUSTER.	

TITLE: CARVED WOOD PLAQUE

COST: ________

SKETCH:



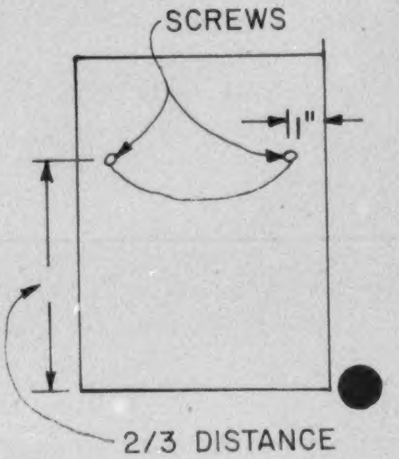
MATERIAL:
BASSWOOD OR PINE

TOOLS & EQUIPMENT: CARVING TOOLS, STEEL SCALE, SCREW DRIVER, HAND SAW, STAIN, DANISH OIL

PROCEDURES:

1. DRAW OR TRACE DESIGN ON WOOD.
2. CUT ALL LINES ON THE CARVING WITH A V TOOL.
3. STOP CUT ALL LINES. A STOP CUT IS MADE BY CUTTING EACH LINE 1/16" TO 1/8" DEEP.
4. CARVE OUT AGAINST THE STOP CUTS IN THE AREAS YOU DESIRE.
5. THE DESIGN SHOULD BE CARVED ABOUT 1/2 THE THICKNESS OF THE WOOD.
6. AFTER THE STOP CUTS AND OTHER CUTS ARE AT THE DESIRED DEPTH, ROUND THE PLAQUE TO SHAPE WITH CARVING TOOLS.
7. MOST CARVED PROJECTS SHOULD NOT BE SANDED. THIS REMOVES THE "CARVED LOOK".
8. FINISH AS DESIRED. STAIN OR OIL LOOK NICE.
9. MOUNT SCREWS AND WIRE ON BACK IN ORDER TO HANG YOUR PLAQUE.

REFERENCES:



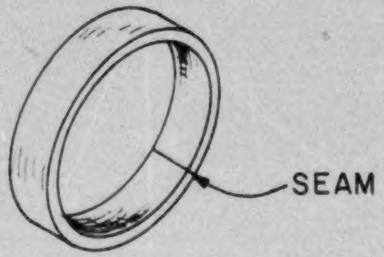
TITLE: MAKING A RING

COST: ________

MATERIAL:

1/4" X 3" STRIP NICKEL SILVER

SKETCH:



TOOLS & EQUIPMENT: PAPER, SCISSORS, WOODEN BLOCK FORM, RING MANDREL, MALLET, FLAT METAL FILE (OPTION), OXIDIZED WIRE, NATURAL GAS TORCH, SILICON CARBIDE ABRASIVE, BUFFER

PROCEDURES:

REFERENCES:

1. CUT PAPER PATTERN 1/4" WIDE AND 3" LONG. FIT TO FINGER AND TAPE. MAKE SURE IT WILL SLIDE ON AND OFF FINGER. MARK FOR LENGTH.
2. CUT 1/4" STRIP OF NICKEL SILVER ON FOOT SQUARING SHEAR. TRIM TO LENGTH ON SHEAR.
3. LAY STRIP OVER WOODEN FORM BLOCK. PLACE RING MANDREL IN MIDDLE OF STRIP AND TAP WITH MALLET TO BEGIN FORMING ROUND SHAPE.
4. REMOVE MANDREL AND TAP ENDS OF STRIP TOWARD EACH OTHER UNTIL ENDS ARE APPROXIMATELY 1/8" APART.
5. PLACE RING, WITH PADDED PROTECTION, IN VISE. USE FLAT METAL FILE AND FILE EDGES OF ENDS STRAIGHT AND FLAT. WHEN ENDS ARE BUTTED TOGETHER THERE SHOULD BE NO GAPS OR LIGHT SHOULD NOT SHOW THROUGH.
6. TIE RING TOGETHER WITH OXIDIZED WIRE TO BRING ENDS OF RING TOGETHER, OR
7. TAP ENDS OF RING SO THAT THEY OVERLAP EACH OTHER BY 1/8". THIS CREATES A SPRINGINESS IN STRIP SO THAT WHEN PULLED APART AND BUTTED TOGETHER, THEY WILL REMAIN IN THAT POSITION.
8. ON SOLDERING BENCH, PROP RING BETWEEN BRICKS WITH SEAM IN UP POSITION, OR ON TOP.
9. PLACE SILVER SOLDER FLUX ON TOP AND BOTTOM OF JOINT.
10. LAY SMALL PIECE OF SILVER SOLDER ON JOINT.
11. ADJUST TORCH TO A SMALL FLAME. APPLY HEAT FROM BOTTOM, FLOW SOLDER ALONG ENTIRE JOINT.

MAKING A RING (CON'T)

12. AFTER RING HAS COOLED, PLACE RING ON MANDREL AND ROUND RING WITH MALLET.
13. FILE SMOOTH WITH MILL SMOOTH HAND FILE. KEEP METAL PARTICLES CLEANED OUT OF FILE WITH CARD FILE.
14. SAND SMOOTH WITH SILICON CARBIDE ABRASIVE STARTING WITH 220 GRIT AND FINISHING WITH 600 GRIT.
15. POLISH WITH BUFFER ON A MANDREL.
16. RINGS MAY BE PEENED ON A MANDREL HELD IN A VISE WITH A POLISHED PEENING HAMMER.

TITLE: "FEELEY"

COST:

MATERIAL:

WALNUT O[illegible] MAPLE, APPROX.
2" X 2" X 4"

SKETCH:

TOOLS & EQUIPMENT: HANDSAW, STATIONARY SANDER, RASP, FILE, SANDPAPER, DANISH OIL

PROCEDURES:

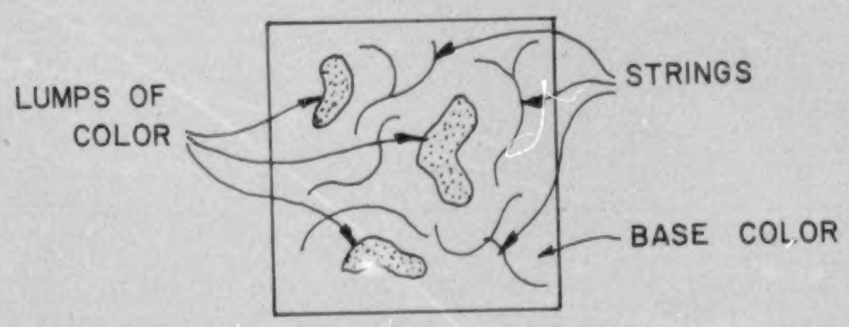
1. SELECT DESIRED WOOD AND CUT WITH HANDSAW (SHORT STORAGE).
2. RECORD COST.
3. SHAPE ON STATIONARY SANDER.
4. SHAPE NEXT WITH WOOD RASP AND WOOD FILE.
5. SAND OUT ALL FILE MARKS WITH #40 GRIT SANDPAPER.
6. SAND OUT ALL #40 MARKS WITH #80 GRIT SANDPAPER.
7. SAND OUT ALL #80 MARKS WITH #120 GRIT SANDPAPER.
8. SAND OUT ALL #120 MARKS WITH #220 GRIT SANDPAPER.
9. APPLY OIL FINISH AND SAND OIL IN WITH #400 PAPER.

REFERENCES:

INFORMATION SHEET

COPPER ENAMELING PROCEDURE

1. GET BLAND COPPER PIECE OR MAKE YOUR OWN.
2. SAND THE FRONT SURFACE THOROUGHLY.
3. APPLY COPPER CLEANER TO THE BACK AND DRY OVER LID OF KILN.
4. DRAW AROUND COPPER SHAPE ON PIECE OF PAPER AND PLAN OUT COLORS OF ENAMEL YOU INTEND TO USE.



5. TEAR OFF SMALL PIECES OF BUTCHER PAPER FOR LAYING COPPER PIECE ON WHEN APPLYING ENAMELS.
6. BRUSH ON GUM SOLUTION TO FRONT SIDE.
7. PLACE ON CLEAN PAPER AND APPLY BASE COLOR.
8. PLACE ON ANOTHER PIECE OF CLEAN PAPER.
9. POUR EXTRA ENAMEL FROM BASE COLOR BACK INTO BOTTLE.
10. APPLY LUMPS OF COLOR AND STRINGS.
11. PLACE COPPER ENAMEL PROJECT IN KILN AND HEAT UNTIL SURFACE ENAMEL HAS MELTED.
12. SWIRL AT THIS TIME IF YOU DESIRE.
13. WHEN REMOVING SWIRL STICKS, BE CAREFUL NOT TO FLIP PROJECT OVER.
14. IF THE SWIRL STICK BONDS TO THE COPPER, REMOVE THE PROJECT FROM THE KILN AND LET COOL. THE SWIRL STICK WILL COME OFF.

POWER MECHANICS LABORATORY EXPERIENCE #1

TUNE UP FOR SMALL ENGINES

REFERENCE:

SMALL GASOLINE ENGINES	BY STEPHENSON	PGS. 119-131
SMALL GAS ENGINES	BY PURVIS	PGS. 115-126
POWER MECHANICS	BY ATTEBERRY	PGS. 77-85
BRIGGS & STRATTON MANUAL		

INTRODUCTION:

ENGINE TUNE-UP DOES NOT INVOLVE MAJOR ENGINE REPAIR WORK; RATHER, IT IS A PROCESS OF CLEANING AND ADJUSTING THE ENGINE SO THAT IT WILL GIVE TOP PERFORMANCE. TUNE-UP CAN BE DONE BY AN EXPERIENCED ENGINE OWNER OR IT CAN BE DONE BY A MECHANIC. TUNE-UP IS TYPICALLY DONE BY THE MECHANIC WHEN AN OWNER BRINGS A LAWNMOWER IN FOR A SPRING CHECKUP PRIOR TO SUMMER USE.

PROCEDURE:

1. INSPECT AIR CLEANER, CLEAN AND REASSEMBLE AIR CLEANER.
2. CLEAN THE GAS TANK, FUEL LINES, AND ANY FUEL FILTERS OR SCREENS.
3. CHECK COMPRESSION.
4. CHECK SPARK PLUG: CLEAN, REGAP OR REPLACE.
5. CHECK OPERATION OF THE GOVERNOR.
6. CHECK MAGNETO.
7. FILL CRANKCASE WITH CLEAN OIL OF THE CORRECT TYPE.
8. FILL GASOLINE TANK WITH REGULAR GASOLINE, BE SURE TO MIX OIL WITH THE GASOLINE IF IT IS A TWO-STROKE CYCLE ENGINE.
9. START ENGINE.
10. ADJUST CARBURETOR FOR PEAK PERFORMANCE.

POWER MECHANICS LABORATORY EXPERIENCE #2

DRAIN OIL REFILL CRANKCASE

REFERENCE: SMALL GASOLINE ENGINES BY STEPHENSON PGS. 58-64

INTRODUCTION:

THE CRANKCASE OIL SHOULD BE CHANGED PERIODICALLY. THE EXACT NUMBER OF OPERATING HOURS BETWEEN OIL CHANGES VARIES FROM MANUFACTURER TO MANUFACTURER. IT MAY BE AS SHORT A TIME AS EVERY 20 HOURS OR AS LONG A TIME AS EVERY 100 HOURS. (EVERY 25 HOURS IS MOST COMMON). TRUE, THE MANUFACTURER'S SUGGESTED OIL CHANGE INTERVAL CAN BE STRETCHED, BUT TO INSURE MINIMUM ENGINE WEAR AND MAXIMUM ENGINE LIFE, FOLLOW THE MANUFACTURER'S LUBRICATION SUGGESTIONS.

MANUFACTURERS GENERALLY RECOMMEND MS (SEVERE DUTY) QUALITY ENGINE OIL; HOWEVER, SOME MANUFACTURERS PERMIT THE USE OF MM (MEDIUM DUTY) OIL. AVOID ML (LIGHT DUTY) OIL. THE VISCOSITY RECOMMENDED IS OFTEN SAE 30 FOR SUMMER AND SAE 20 FOR WINTER. OF COURSE HERE, TOO, THERE ARE VARIATIONS.

IT IS A GOOD IDEA TO DRAIN THE OIL WHEN THE ENGINE IS HOT SINCE MORE DIRT AND SLIGHTLY MORE OIL CAN BE REMOVED. REMEMBER, DIRTY OIL SHOULD BE REPLACED BECAUSE IT WILL NOT GIVE PROPER, HIGH QUALITY LUBRICATION.

PROCEDURE:

THE FOLLOWING PROCEDURE IS A GENERAL GUIDE AND SPECIFIC STEPS OF THE PROCEDURE MAY BE REVISED SINCE THERE ARE MANY MAKES OF ENGINES.

1. REMOVE THE ADD-OIL PLUG.

2. LOOSEN AND CAREFULLY REMOVE THE DRAIN PLUG. DO NOT DROP THE PLUG WHEN IT COMES OUT OF THE ENGINE. BE SURE TO HAVE A CONTAINER RIGHT UNDER THE DRAIN HOLE.

3. ALLOW OIL TO DRAIN, THEN TIP THE ENGINE SLIGHTLY TO GET THE LAST BIT OF OIL FROM THE ENGINE.

4. REPLACE THE DRAIN PLUG. DO NOT "OVERTIGHTEN".

5. REFILL THE CRANKCASE WITH CLEAN OIL OF THE CORRECT QUALITY AND VISCOSITY.

6. CHECK THE OIL LEVEL WITH THE DIP STICK IF THE ENGINE HAS ONE. ON ENGINES NOT HAVING A DIP STICK, FILL THE CRANKCASE UNTIL OIL CAN BE SEEN AT THE HOLE OR IN THE FILL PIPE.

7. REPLACE THE ADD-OIL PLUG.

POWER MECHANICS LABORATORY EXPERIENCE #3

CLEAN AND REGAP SPARK PLUGS

REFERENCE:	SMALL GASOLINE ENGINES	BY STEPHENSON	PGS. 100-106
	SMALL GAS ENGINES	BY PURVIS	PGS. 205
	POWER MECHANICS	BY ATTEBERRY	PGS. 79

INTRODUCTION:

SPARK PLUG PERFORMANCE CAN OFTEN BE IMPROVED BY PERIODIC CLEANING. ALSO, SPARK PLUG LIFE CAN BE LENGTHENED. MOST MANUFACTURERS OF ENGINES RECOMMEND THAT SPARK PLUGS BE CLEANED EVERY 100 HOURS OF ENGINE OPERATION. OF COURSE, IF A PLUG IS DAMAGED, INSULATOR CRACKED, ELECTRODES WORN AWAY, ETC., CLEANING CANNOT REPAIR THE DAMAGE.

SPARK PLUGS ARE OFTEN FOULED IN ANY OF FIVE WAYS: OIL FOULING IS INDICATED BY WET, OIL DEPOSITS. THIS CONDITION IS CAUSED WHEN OIL IS PUMPED (BY THE PISTON RINGS) TO THE COMBUSTION CHAMBER. A HOTTER SPARK PLUG MAY HELP BUT THE CONDITION MAY HAVE TO BE REMEDIED BY ENGINE OVERHAUL.

GAS FOULING OR FUEL FOULING IS INDICATED BY A SOOTY, BLACK DEPOSIT ON THE INSULATOR TIPS, THE ELECTRODES AND SHELL SURFACES. THE CAUSE MAY BE EXCESSIVELY RICH FUEL MIXTURE, LIGHT LOADS, OR LONG PERIODS AT IDLE SPEED.

CARBON FOULING IS INDICATED IF THE PLUG HAS DRY, FLUFFY BLACK DEPOSITS. THIS CONDITION MAY BE CAUSED BY EXCESSIVELY RICH FUEL MIXTURE; IMPROPER CARBURETOR ADJUSTMENT, CHOKE PARTLY CLOSED, CLOGGED AIR CLEANER. ALSO SLOW SPEEDS, LIGHT LOADS, LONG PERIODS OF IDLING AND THE RESULTING "COOL" OPERATING TEMPERATURE MAY CAUSE DEPOSITS NOT TO BE BURNED AWAY. A HOTTER SPARK PLUG MAY CORRECT CARBON FOULING.

LEAD FOULING IS INDICATED BY A SOFT, TAN, POWDERY DEPOSIT ON THE PLUG. THESE DEPOSITS OF LEAD SALTS BUILD UP DURING LOW SPEEDS AND LIGHT LOADS. THEY CAUSE NO PROBLEM AT LOW SPEED BUT AT HIGH SPEEDS, WHEN THE PLUG HEATS UP, THE FOULING WILL OFTEN CAUSE THE PLUG TO MISFIRE, THUS LIMITING THE ENGINE'S TOP PERFORMANCE.

BURNED ELECTRODES ARE INDICATED BY THINNED OUT, WORN AWAY ELECTRODES. THIS CONDITION IS CAUSED BY THE LEAN FUEL MIXTURE, LOW OCTANE FUEL, COOLING SYSTEM FAILURE, OR LONG PERIODS OF HIGH SPEED-HEAVY LOAD. A COLDER PLUG MAY CORRECT THIS TROUBLE.

CORRECT SPARK PLUG TYPE AND CORRECT SPARK PLUG GAP SETTING ARE FOUND IN THE ENGINE OPERATOR'S MANUAL.

PROCEDURE

1. REMOVE THE SPARK PLUG - EXAMINE CONDITION OF PLUG.
2. CHECK SPARK GAP PRIOR TO CLEANING AND RESETTING.
3. WIRE BRUSH SHELL AND THREADS.
4. CLEAN INSULATOR WITH A RAG SOAKED IN SOLVENT.
5. CLEAN ELECTRODES AND SPARKING SURFACES.
6. REGAP THE PLUG TO THE CORRECT SETTING.
7. REINSTALL PLUG (DON'T FORGET THE SPARK PLUG GASKET).

POWER MECHANICS LABORATORY EXPERIENCE #4

CLEAN AND ADJUST THE BREAKER POINTS

REFERENCE:		
SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 119-131
SMALL GAS ENGINES	BY PURVIS	PAGE 190
POWER MECHANICS	BY ATTEBERRY	PAGES 36-46
BRIGGS & STRATTON MANUAL		

INTRODUCTION:

THE CORRECT SETTING OF THE BREAKER POINTS IS ESSENTIAL TO THE OPERATION OF THE MAGNETO. THE MAXIMUM OPENING TO THE POINTS IS MOST OFTEN .020". HOWEVER, SOME MAGNETOS SPECIFY .018", .023", OR OTHER SETTINGS. CHECK THE MANUFACTURER'S RECOMMENDATIONS.

THE BREAKER POINTS SHOULD FULLY LINE UP WITH EACH OTHER, AND THEY SHOULD CONTACT FLAT AGAINST EACH OTHER. THE BREAKER POINTS HAVE A CHROME OR SILVERY APPEARANCE WHEN THEY ARE NEW AND AS THEY ARE USED THEY BECOME GRAY. IF THEY HAVE BEEN PITTED THEY SHOULD BE REPLACED.

PROCEDURE:

1. REMOVE THE SPARK PLUG LEAD.
2. REMOVE THE AIR SHROUD, GRASS SCREENS, ETC., IN THE AREA OF THE MAGNETO.
3. REMOVE THE FLYWHEEL. THIS IS NOT NECESSARY IF THE POINTS ARE NOT LOCATED UNDER THE FLYWHEEL. SOME FLYWHEEL NUTS HAVE LEFT HAND THREADS.
4. REMOVE BREAKER POINT COVER.
5. ROTATE THE CRANKSHAFT UNTIL MAXIMUM POINT OPENING IS ATTAINED.
6. CHECK THE BREAKER POINT GAP, USING A FLAT FEELER GAUGE, PRIOR TO CLEANING AND RESETTING.
7. CLEAN THE POINTS WITH ALCOHOL ON A LINT-FREE CLOTH.
8. LOOSEN THE BREAKER POINT ASSEMBLY LOCK SCREW.
9. WITH POINTS AT MAXIMUM OPENING, TURN THE BREAKER POINT ADJUSTING SCREW TO ATTAIN THE CORRECT SETTING. CHECK THE SETTING WITH A FLAT FEELER GAUGE.
10. TIGHTEN BREAKER POINT ASSEMBLY LOCK SCREW.
11. ROTATE THE CRANKSHAFT SEVERAL TIMES.
12. RECHECK BREAKER POINT SETTING WITH A FLAT FEELER GAUGE.

POWER MECHANICS LABORATORY EXPERIENCE #5

BASIC FLYWHEEL MAGNETO PARTS

REFERENCE:	SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 84-95
	POWER MECHANICS	BY ATTEBERRY	UNIT 4
	SMALL GAS ENGINES	BY PURVIS	PAGE 193

INTRODUCTION:

The magneto ignition system is a very reliable and trouble-free system. Of course, one big advantage of the magneto is that it does not require a storage battery for a power source. The magneto provides the spark for ignition, voltages of a few hundred volts are stepped up to about 20,000 volts, enough to jump the spark gap in the spark plug.

There are seven basic parts which work together to produce the ignition spark:

1. High Tension Coil
2. Laminated Iron
3. Condenser
4. Breaker Points
5. Permanent Magnets
6. Spark Plug Lead
7. Spark Plug

A brief review of the complete magneto cycle might be helpful in the study of the parts. When the permanent magnet is far away from the high-tension coil, it has no effect on the coil. But as the permanent magnet comes closer and closer, the primary coil "Feels" the increasing magnetic field. The coil is being cut by magnetic lines of force, and therefore, there is current in the primary coil. This current travels through the breaker points and into ground. When the permanent magnet is just about opposite the high-tension coil, the magnetic field around both coils is reaching its peak. Also, the piston is reaching the top of its stroke, compressing the fuel mixture.

The breaker cam causes the breaker points to open quickly. With the primary circuit broken, the electron flow immediately stops. When the flow of electrons stops, the magnetic field that was built up around the primary and secondary coils collapses very quickly. Magnetic lines of force are, therefore, cutting the coils very rapidly and high voltages are induced in the coils. In the secondary coil the voltage may reach 18,000 to 20,000 volts, enough to jump across the spark gap in the spark plug. This spark ignites the fuel mixture and the piston is forced down the cylinder.

You are to disassemble the engine to expose flywheel magneto parts. Study the arrangement of the parts. Turn the engine over and observe how the breaker points are opened and closed. Remove the basic parts of the ignition system for closer inspection. The following procedure is a general guide and specific steps of the procedure may be revised since there are many makes of engines.

PROCEDURE:

1. Remove spark plug lead from spark plug.

2. Remove any air shrouding, grass screens, recoil starters, etc. from the flywheel area.

BASIC FLYWHEEL MAGNETO PARTS (CONTINUED)

3. REMOVE THE FLYWHEEL AND FLYWHEEL NUT. USE A FLYWHEEL PULLER IF ONE IS AVAILABLE. IF A FLYWHEEL PULLER IS NOT AT HAND, DELIVER A SHARP BLOW TO THE END OF THE CRANKSHAFT WITH A PLASTIC OR SOFT HAMMER. NUT SHOULD BE ON END OF SHAFT WHEN YOU STRIKE THE SHARP BLOW.

4. REMOVE BREAKER POINT COVER (ON SOME ENGINES).

5. TURN THE CRANKSHAFT OVER AND OBSERVE THE OPENING AND CLOSING OF THE POINTS.

6. REMOVE THE HIGH-TENSION COIL AND LAMINATED IRON CORE.

7. REMOVE THE CONDENSER.

8. REMOVE THE BREAKER POINT ASSEMBLY.

9. REMOVE THE BREAKER CAM (ON SOME ENGINES).

REASSEMBLY PROCEDURE

REVERSE THE DISASSEMBLY PROCEDURE. IF THE ENGINE IS TO BE OPERATED UPON REASSEMBLY, SEVERAL POINTS ARE VERY IMPORTANT:

1. REINSTALL THE BREAKER CAM IN THE SAME WAY AS IT CAME OFF.

2. USE CARE WITH THE KEY AND THE KEYWAYS. DON'T FORCE.

3. BREAKER POINTS WILL NEED TO BE RESET TO MANUFACTURER'S SPECIFICATIONS.

4. LAMINATED IRON CORE MUST BE POSITIONED FOR THE PROPER AIR GAP BETWEEN IT AND THE FLYWHEEL MAGNETO.

5. ALL CONNECTIONS SHOULD BE CHECKED FOR TIGHTNESS.

POWER MECHANICS LABORATORY EXPERIENCE #6

CHECK ENGINE COMPRESSION

REFERENCE:			
	SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 119-131
	SMALL GAS ENGINES	BY PURVIS	PAGES 21-23
	POWER MECHANICS	BY ATTEBERRY	PAGE 84

INTRODUCTION:

GOOD COMPRESSION IS ESSENTIAL FOR OPTIMUM ENGINE PERFORMANCE. FUEL MIXTURE MUST BE TIGHTLY COMPRESSED TO INSURE PROPER IGNITION AND MAXIMUM POWER. POOR COMPRESSION CAN BE CAUSED BY WORN PISTON RINGS, BAD VALVES, WORN OR WARPED CYLINDERS, LEAKAGE THROUGH THE HEAD GASKET, OR LEAKAGE AROUND THE SPARK PLUG. POOR COMPRESSION IS A COMMON TROUBLE ESPECIALLY WITH OLDER ENGINES THAT ARE IN NEED OF AN OVERHAUL.

IF AN ENGINE STARTS WITH DIFFICULTY OR LACKS POWER AND IS SLUGGISH, A TROUBLE-SHOOTER MIGHT SUSPECT POOR COMPRESSION AS THE POSSIBLE CAUSE FOR THESE TROUBLES. CHECKING THE ENGINE'S COMPRESSION IS A PART OF MOST TUNE-UP PROCEDURES. GENERALLY, EACH ENGINE MANUFACTURER SPECIFIES HIS OWN RECOMMENDED METHOD FOR CHECKING ENGINE COMPRESSION.

PROCEDURE:

1. CHECKING COMPRESSION WITHOUT A COMPRESSION GAUGE.

   A. REMOVE THE SPARK PLUG HIGH-TENSION LEAD FROM THE SPARK PLUG.

   B. TURN THE ENGINE OVER SLOWLY BY HAND. AS THE PISTON REACHES TOP-DEAD-CENTER, CONSIDERABLE RESISTANCE SHOULD BE FELT. AS TOP-DEAD-CENTER IS PASSED, THE PISTON SHOULD "SNAP" BACK DOWN THE CYLINDER, INDICATING GOOD COMPRESSION.

2. CHECKING COMPRESSION WITH A COMPRESSION GAUGE.

   A. REMOVE THE SPARK PLUG LEAD FROM THE SPARK PLUG.

   B. REMOVE THE SPARK PLUG.

   C. CAREFULLY CLEAN ANY DIRT OR FOREIGN MATTER FROM AROUND THE SPARK PLUG HOLE.

   D. HOLD THE COMPRESSION GAUGE TIGHTLY AGAINST THE SPARK PLUG HOLE. (SOME GAUGES SCREW INTO THE HOLE).

   E. TURN THE ENGINE OVER AS IF YOU WERE STARTING IT.

   F. READ THE COMPRESSION GAUGE. READINGS OF 60 TO 80 POUNDS PER SQUARE INCH (PSI) GENERALLY INDICATE GOOD COMPRESSION. HOWEVER, SOME ENGINES MAY HAVE A COMPRESSION RANGE OF 110 TO 120 (PSI). THE EXACT DATA FOR THE ENGINE YOU ARE WORKING ON SHOULD BE AT HAND.

POWER MECHANICS LABORATORY EXPERIENCE #7

ENGINE DISASSEMBLY (FOUR-STROKE CYCLE)

REFERENCE:			
	SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 9-21
	SMALL GAS ENGINES	BY PURVIS	
	POWER MECHANICS	BY ATTEBERRY	

GENERAL GUIDE FOR DISASSEMBLY PROCEDURE

1. DRAIN OIL FROM CRANKCASE.
2. DISCONNECT SPARK PLUG CABLE AND REMOVE SPARK PLUG.
3. DRAIN GAS TANK, DISCONNECT FUEL LINE, REMOVE GAS TANK.
4. REMOVE AIR CLEANER (USE CARE IF IT CONTAINS OIL).
5. DRAIN CARBURETOR, REMOVE THROTTLE AND GOVERNOR CONNECTIONS, REMOVE CARBURETOR FROM ENGINE.
6. REMOVE METAL AIR SHROUDING. TRY TO KEEP PARTS IN SEPARATE CONTAINERS.
7. REMOVE CRANKSHAFT NUT, ALSO GRASS SCREENS, STARTER PULLEYS, ETC.
8. REMOVE FLYWHEEL.
9. REMOVE THE MAGNETO PLATE ASSEMBLY. (THE MAIN BEARING IS ON THE FLYWHEEL SIDE OF THIS PLATE.)
10. REMOVE CYLINDER HEAD.
11. REMOVE THE CRANKCASE FROM THE ENGINE BASE. (THIS MAY NOT BE NECESSARY IF THE ENGINE HAS AN INSPECTION PLATE.)
12. UNBOLT THE CONNECTING ROD CAP AND PUSH THE PISTON AND ROD UP AND OUT OF THE CYLINDER.
13. REMOVE THE CRANKSHAFT BY PULLING IT OUT. (THE MAIN BEARING PLATE MAY HAVE TO BE LOOSENED TO DO THIS.)

REASSEMBLY PROCEDURE

REVERSE THE DISASSEMBLY PROCEDURE. LISTED BELOW ARE SOME POINTS TO REMEMBER IN REASSEMBLY:

1. TIGHTEN ALL MACHINE SCREWS AND BOLTS SECURELY.
2. BE CERTAIN THE PISTON IS REINSTALLED EXACTLY AS IT CAME OUT.
3. LINE UP TIMING MARKS ON CRANKSHAFT WITH TIMING MARK ON CAMSHAFT.
4. LINE UP MATCH MARK ON CONNECTING ROD CAP WITH MATCH MARK ON CONNECTING ROD.

REASSEMBLY PROCEDURE (CONTINUED)

5. TORQUE HEAD BOLTS TO MANUFACTURER'S SPECIFICATIONS.
6. BE CERTAIN FLYWHEEL KEYWAY SLIPS INTO THE KEY ON THE CRANKSHAFT.
7. CHECK ALL GASKETS. REPLACEMENT MAY BE NECESSARY, ESPECIALLY IF THE ENGINE IS TO BE OPERATED.
8. REFILL CRANKCASE WITH OIL IF ENGINE IS TO BE OPERATED.
9. REFILL GAS TANK IF ENGINE IS TO BE OPERATED.

POWER MECHANICS LABORATORY EXPERIENCE #8

VALVE TRAIN AND CAMSHAFT (FOUR-STROKE CYCLE)

REFERENCE:			
	SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 9-21
	SMALL GAS ENGINES	BY PURVIS	PAGES 80-96
	POWER MECHANICS	BY ATTEBERRY	PAGES 16-23

INTRODUCTION:

THE ENGINE'S VALVES, EXHAUST AND INTAKE, PROVIDE A ROUTE FOR EXHAUST GASES TO ESCAPE AND A ROUTE FOR NEW FUEL MIXTURE TO ENTER. THE VALVES ARE OF THE POPPET TYPE, BEING RAISED OFF THEIR SEATS WHEN THEY ARE OPENED. THEY ARE SUBJECTED TO SEVERE PUNISHMENT IN THE COMBUSTION CHAMBER BUT STILL MUST FUNCTION PERFECTLY, OPENING AT EXACTLY THE RIGHT INSTANT AND CLOSING TO MAKE AN AIRTIGHT SEAL. THE PARTS THAT WORK WITH THE VALVES ARE REFERRED TO AS THE VALVE TRAIN AND CAMSHAFT.

DISASSEMBLY PROCEDURE:

1. REMOVE THE VALVE PLATE EXPOSING THE VALVE SPRINGS, VALVE LIFTERS, AND VALVE STEMS.
2. COMPRESS THE VALVE SPRING WITH A VALVE SPRING COMPRESSOR.
3. REMOVE THE VALVE SPRING RETAINERS BY SLIPPING OR FLIPPING THEM OUT.
4. PULL THE VALVE OUT OF THE ENGINE.
5. REMOVE THE VALVE SPRING, STILL COMPRESSED.
6. REMOVE THE CAMSHAFT. IF THE CAMSHAFT IS HELD IN THE CRANKCASE WITH A CAMSHAFT SUPPORT PIN, IT MUST BE DRIVEN OUT WITH A BLUNT PUNCH. IN MOST CASES, DRIVE THE PUNCH FROM THE TAKEOFF SIDE TOWARD THE FLYWHEEL SIDE. OBSERVE TIMING MARKS.
7. PULL OUT THE CAMSHAFT.
8. REMOVE THE VALVE LIFTERS. THEY WILL PROBABLY FALL OUT WHEN THE CAMSHAFT IS REMOVED.

REASSEMBLY PROCEDURE

REVERSE THE DISASSEMBLY PROCEDURE. HERE ARE SOME POINTS TO REMEMBER:

1. REINSTALL THE INTAKE AND EXHAUST VALVES IN THEIR CORRECT PLACES.
2. A SPECIAL TOOL IS NEEDED TO AID IN THE INSTALLATION OF VALVE SPRING RETAINERS ON SOME ENGINES.
3. REINSTALL THE CAMSHAFT SUPPORT PIN CORRECTLY: FROM FLYWHEEL SIDE TO THE POWER TAKEOFF SIDE, IN MOST CASES.
4. LINE UP TIMING MARKS.

POWER MECHANICS LABORATORY EXPERIENCE #9

LAP VALVES

REFERENCE:			
	SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 119-131
	SMALL GAS ENGINES	BY PURVIS	PAGE 84
	POWER MECHANICS	BY ATTEBERRY	PAGE 21

INTRODUCTION:

THE VALVE MUST MAKE A GAS TIGHT SEAL IN THE CYLINDER UNDER THE EXPLOSION PRESSURE OF SEVERAL HUNDRED POUNDS. VALVES OPERATE UNDER VERY ADVERSE CONDITIONS. IF THE ENGINE IS RUNNING AT 4,000 RPMS, EACH VALVE WILL SEAL AND UNSEAL 2,000 TIMES PER MINUTE OR ABOUT 33 TIMES PER SECOND. THEY ARE EXPOSED TO HEAT WHICH APPROACHES 5,000 DEGREES F., FAR ABOVE THE MELTING POINT OF IRON. IF THE VALVES OR VALVE SEATS BECOME WORN, CRACKED OR WARPED, SLUGGISH ENGINE OPERATION AS WELL AS OTHER PROBLEMS WILL RESULT. UPON OVERHAULING AN ENGINE, THE VALVE AND VALVE SEAT CONDITION ARE CHECKED. SOMETIMES EITHER OR BOTH THE VALVE SEATS AND VALVES ARE REGROUND. IF VALVES OR VALVE SEATS HAVE BEEN REGROUND OR REPLACED, THEY SHOULD BE LAPPED. LAPPING FORMS THE NECESSARY PERFECT SEAL BETWEEN THE SEAT AND THE VALVE. VALVES SHOULD BE LAPPED EACH TIME THE ENGINE IS REBUILT.

DISASSEMBLY PROCEDURE:

1. REMOVE THE VALVE SPRING COVER EXPOSING THE VALVE SPRINGS.
2. REMOVE THE CYLINDER HEAD.
3. COMPRESS THE VALVE SPRING WITH A VALVE SPRING COMPRESSOR.
4. REMOVE THE VALVE SPRING RETAINERS BY SLIPPING OR FLIPPING THEM OUT.
5. REMOVE THE VALVE SPRING, STILL COMPRESSED.
6. PULL THE VALVE OUT OF THE ENGINE.
7. INSPECT THE VALVE AND VALVE SEAT.
8. REPLACE THE VALVE AND VALVE SEAT OR REGRIND THE VALVE AND VALVE SEAT ONLY ON INSTRUCTIONS FROM THE INSTRUCTOR.
9. LAP THE VALVES. PLACE A SMALL AMOUNT OF LAPPING COMPOUND ON THE VALVE FACE AND ROTATE THE VALVE AGAINST ITS SEAT A FEW TIMES. LAP THE VALVES UNTIL THERE IS A THIN, DULL RING AROUND THE ENTIRE VALVE FACE. THE RING INDICATES THAT THE VALVE WILL SEAT WELL. DO NOT LAP THE VALVES EXCESSIVELY.
10. CLEAN THE VALVE AND OIL THE VALVE STEM.

REASSEMBLY PROCEDURE

REVERSE THE DISASSEMBLY PROCEDURE. REMEMBER TO PUT THE EXHAUST VALVE IN THE EXHAUST SIDE AND THE INTAKE VALVE IN THE INTAKE SIDE. ON SOME ENGINES A MAGNETIC VALVE RETAINER INSERTER IS A GREAT HELP. THE RETAINERS OFTEN COME OUT EASILY BUT ARE DIFFICULT TO REINSTALL.

POWER MECHANICS LABORATORY EXPERIENCE #10

REPLACE PISTON RINGS

REFERENCE:			
	SMALL GASOLINE ENGINES	BY STEPHENSON	PAGES 119-131
	SMALL GAS ENGINES	BY PURVIS	PAGES 68-69
	POWER MECHANICS	BY ATTEBERRY	PAGES 18-20

INTRODUCTION:

THE PISTON RINGS FIT INTO THE SLOTTED GROOVES AROUND THE PISTON AND THEY PROVIDE THE SEAL BETWEEN THE MOVING PISTON AND THE CYLINDER WALL. THE RINGS ACTUALLY EXERT A PRESSURE ON THE CYLINDER WALL. AN OIL FILM BETWEEN THE RINGS AND THE CYLINDER WALL PREVENTS EXCESSIVE FRICTION AND PROVIDES A POWER SEAL. THE TWO TYPES OF PISTON RINGS ARE (1) COMPRESSION RINGS, AND (2) OIL CONTROL RINGS.

THE PISTON RINGS ARE EXPOSED TO EXTREMELY HARD USAGE AND OVER A LONG PERIOD OF TIME IT IS QUITE POSSIBLE THAT REPLACEMENT WITH NEW RINGS MAY BE NEEDED. WORN PISTON RINGS CAN RESULT IN LOSS OF POWER, EXCESSIVE OIL CONSUMPTION, CRANKCASE DILUTION, HARD STARTING, TO LIST A FEW OF THE PROBLEMS. THE REPLACEMENT OF PISTON RINGS IS A COMMON REPAIR JOB AND IS GENERALLY DONE WHEN THE ENGINE IS OVERHAULED. IT MIGHT BE NOTED THAT THE CONDITION OF THE CYLINDER WALL ALSO HAS A BEARING ON PISTON RING EFFICIENCY. WORN OR WARPED CYLINDER WALLS CANNOT BE CORRECTED WITH NEW RINGS; HONING OR REBORING OF THE CYLINDER WOULD BE NECESSARY.

DISASSEMBLY PROCEDURE

THE FOLLOWING PROCEDURE IS YOUR GENERAL GUIDE FOR FOUR-STROKE CYCLE ENGINES.

1. REMOVE THE NECESSARY PARTS TO EXPOSE THE CRANKSHAFT.
2. REMOVE THE CYLINDER HEAD.
3. REMOVE THE CONNECTING ROD CAP (NOTE MARKINGS ON THE CAP SO IT CAN BE REASSEMBLED IN THE SAME MANNER).
4. PUSH THE PISTON ASSEMBLY UP AND OUT OF THE ENGINE (MARK THE PISTON SO THAT IT CAN BE REINSTALLED THE SAME WAY IT CAME OUT).
5. INSPECT THE CONDITION OF THE PISTON.
6. CHECK THE EDGE GAP WITH A FEELER GAUGE (RINGS ARE STILL ON THE PISTON).
7. REMOVE THE PISTON RINGS WITH A PISTON RING EXPANDER.
8. CAREFULLY PUT THE RING IN THE CYLINDER AND CHECK THE END GAP WITH A FEELER GAUGE.
9. CLEAN THE PISTON RING GROOVES, REMOVING ANY CARBON ACCUMULATION.
10. INSTALL NEW RINGS OR REINSTALL OLD RINGS USING A PISTON RING EXPANDER.

DISASSEMBLY PROCEDURE (CONTINUED)

11. PUSH THE PISTON ASSEMBLY BACK INTO THE CYLINDER WITH THE AID OF A PISTON RING COMPRESSOR.

12. REASSEMBLE PISTON ASSEMBLY TO CRANKSHAFT.

ALL MOTOR DRIVEN VEHICLES WHICH YOU WANT TO BRING TO THE SHOP MUST BE CLEARED BY AN INSTRUCTOR (MOTOR BIKE, MOTORCYCLE, MINI BIKE, GO CART)

INSTRUCTION SHEET FOR BRINGING VEHICLE TO SCHOOL

1. FILL OUT PLAN SHEET, SPECIFICALLY LISTING ALL WORK TO BE DONE ON VEHICLE.
2. SECURE INSTRUCTOR APPROVAL ON YOUR PLAN SHEET.
3. IF THE PART TO BE REPAIRED CAN BE REMOVED FROM THE VEHICLE, IT SHOULD BE BROUGHT IN SEPARATELY. BRING CONTAINER.
4. NON-LICENSED VEHICLES MUST BE BROUGHT TO SCHOOL BY A TRUCK OR CAR. THEY ARE NOT TO BE RIDDEN OR PUSHED TO AND FROM SCHOOL.
5. NO MOTOR DRIVEN VEHICLE TO REMAIN AT SCHOOL OVERNIGHT, WITHOUT SPECIFIC PERMISSION FROM AN INSTRUCTOR.
6. SECURE YOUR PARENTS' SIGNATURE ON YOUR PLAN SHEET TO SHOW THAT THEY APPROVE OF YOUR PROJECT.
7. CONSULT INSTRUCTOR TO ARRIVE AT A DATE FOR YOU TO DO YOUR WORK.
8. WHEN YOU FINISH YOUR WORK, HAVE THE INSTRUCTOR INITIAL A RELEASE ON THE PLAN SHEET.

PROCEDURE FOR DISASSEMBLY OF FOUR STROKE CYCLE ENGINE

NOTE: THIS PROCEDURE TO BE USED ON THE MOUNTED SHOP MODEL ENGINE.

1. REMOVE AIR CLEANER, 1 NUT, 1 BOLT.
2. REMOVE GAS TANK, 2 BOLTS.
3. REMOVE CARBURETOR, 2 BOLTS.
4. REMOVE MUFFLER
5. REMOVE NUT ON FLYWHEEL (LEFT HANDED THREADS).
6. REMOVE ROPE PULLEY AND SCREEN.
7. REPLACE NUT SO IT IS FLUSH WITH END OF SHAFT. PULL ON BACK OF FLYWHEEL WITH FINGERS AND TAP END OF SHAFT WITH A BALLPEEN HAMMER. DO NOT MASH END OF SHAFT WITH HAMMER.
8. REMOVE FLYWHEEL.
9. REMOVE KEY FROM KEY WAY.
10. REMOVE BREAKER PLATE COVER, 2 BOLTS.
11. REMOVE BREAKER PLATE, 4 BOLTS.
12. REMOVE SPARK PLUG.
13. REMOVE CYLINDER HEAD, 6 BOLTS, 6 WASHERS.
14. REMOVE VALVE COVER, 1 NUT.
15. REMOVE OIL SPRAY SHIELD.
16. REMOVE BREATHER ASSEMBLY. NOTE ASSEMBLY OF THIS UNIT FOR PROPER REASSEMBLY. HOLD SPRING WHEN TAKEN OUT.
17. WITH VALVE SPRING COMPRESSOR, COMPRESS VALVE SPRINGS AND REMOVE LOCK PINS. LARGE SPRING IS FOR THE EXHAUST VALVE. LEAVE VALVE SPRINGS IN BLOCK. NOTE MARKINGS ON VALVES FOR PROPER ASSEMBLY.
18. REMOVE CYLINDER ASSEMBLY, 2 BOLTS.
19. TURN OVER CYLINDER ASSEMBLY.
20. REVOLVE PISTON TO B.D.C. (BOTTOM DEAD CENTER).
21. NOTICE FILE MARKS ON ROD AND CAP ON CAMSHAFT SIDE FOR PROPER ASSEMBLY.
22. REMOVE CONNECTING ROD CAP, LOCK AND OIL DIPPER, 2 BOLTS.
23. PUSH PISTON AND ROD OUT THROUGH TOP OF CYLINDER.
24. REMOVE PISTON PIN RETAINER SPRINGS. REMOVE SPRING ON END WHERE PISTON PIN IS RECESSED FIRST.
25. PUSH OUT PISTON PIN.
26. REMOVE CONNECTING ROD.
27. REMOVE CRANKSHAFT FROM BLOCK. NOTE TIMING MARKS, NICK ON CRANKSHAFT AND LINE ON CAM GEAR, FOR PROPER ASSEMBLY.

DISASSEMBLY OF FOUR STROKE CYCLE ENGINE (CONTINUED)

28. REMOVE OIL FILLER PLUG.

29. REMOVE OIL DRAIN PLUG.

IGNITION PROCEDURE

1. REMOVE CONDENSOR, 1 BOLT.)
2. REMOVE BREAKER POINTS, 1 SCREW. } LAY ON BREAKER PLATE.

POWER MECHANICS LABORATORY EXPERIENCE

PROCEDURE FOR DISASSEMBLY OF TWO STROKE CYCLE ENGINE

NOTE: THIS PROCEDURE TO BE USED ON MOUNTED SHOP MODEL ENGINE. PUT ALL PARTS ON CORRECT PLACE ON BOARD.

1. REMOVE FLYWHEEL CAP NUT FROM SHAFT.
2. REMOVE FLYWHEEL.
3. REMOVE 3 BOLTS FROM BREAKER PLATE COVER.
4. REMOVE BREAKER PLATE COVER.
5. PUSH LOCKING PIN TOWARD LARGE END OF PIN RETAINER. DO NOT REMOVE SPRING KEEPER OR SPRING. WHEN PIN IS CLEAR OF SMALL END OF PIN RETAINER, DROP SMALL END OF PIN RETAINER DOWN AND PULL OUT PIN KEEPING SPRING AND KEEPER ON PIN. NOTE HOW PARTS FIT TOGETHER FOR PROPER ASSEMBLY.
6. REMOVE PIN RETAINER AND CAM.
7. REMOVE 3 BOLTS FROM BREAKER PLATE.
8. REMOVE BREAKER PLATE.
9. UNSNAP AND REMOVE AIR CLEANER COVER.
10. REMOVE FILTER FROM AIR CLEANER.
11. REMOVE 2 BOLTS INSIDE AIR CLEANER HOUSING. AIR CLEANER WILL THEN COME OFF.
12. REMOVE 4 BOLTS FROM REED PLATE.
13. REMOVE REED PLATE AND CARBURETOR.
14. REMOVE REED PLATE FROM CARBURETOR, 2 BOLTS.
15. REMOVE SPARK PLUG.
16. REMOVE 4 BOLTS FROM CYLINDER HEAD.
17. REMOVE CYLINDER HEAD (NOTE WHICH SIDE IS UP FOR PROPER ASSEMBLY).
18. REMOVE CONNECTING ROD CAP (NOTE: FILE MARKS ON ROD CAP ON CONNECTING ROD FOR PROPER ASSEMBLY).
19. REMOVE PISTON AND ROD.
20. REMOVE TWO PISTON PIN RETAINING SPRINGS.
21. PUSH PISTON PIN OUT AND REMOVE ROD.
22. LIFT OUT CRANKSHAFT. NOTE WHICH END IS UP FOR PROPER ASSEMBLY.

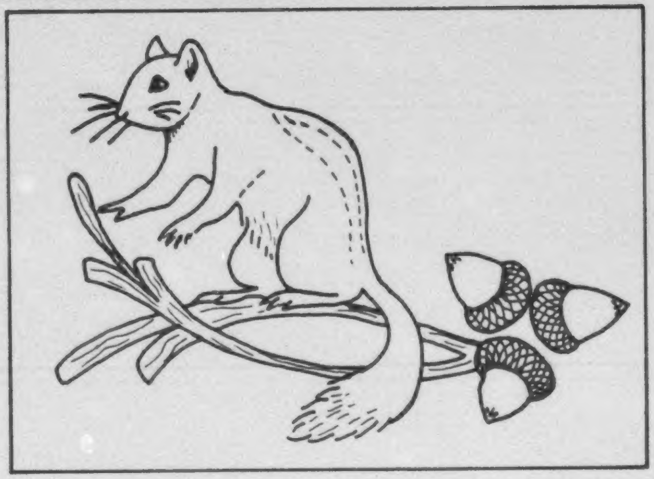
IGNITION PROCEDURE

1. REMOVE CONDENSER AND POINTS IN ONE UNIT. LAY ON BREAKER PLATE. DO NOT REMOVE COIL.

TITLE: DRY POINT ENGRAVING

COST: ________

SKETCH:



MATERIAL:

1 PC. 3 X 3 VINYLITE .015"

INK, WATER BASE

WATER

MATT PAPER

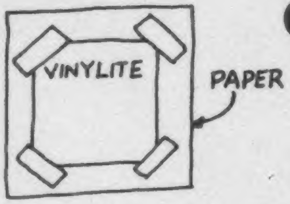
TOOLS & EQUIPMENT: PIN VICE, PHONOGRAPH NEEDLE OR ANY SHARP POINTED TOOL, PAPER TOWEL, NEWSPAPER, TAPE, WATER, SHEET METAL SLIP ROLL, PAPERCUTTER

PROCEDURES:

1. CHOOSE AND DRAW A DESIGN ON PAPER THAT WILL LEND ITSELF TO LINE REPRODUCTION. A LINE DRAWING IS ONE THAT IS MADE UP OF LINES, NOT SHADED AREAS.
2. CUT VINYLITE, MAXIMUM SIZE 3 X 3, ABOUT 1" LARGER THAN DESIGN, TAPE VINYLITE TO DESIGN.
3. ENGRAVE THE DESIGN INTO THE PLATE VINYLITE USING A PHONOGRAPH NEEDLE IN A PIN VICE OR ANY TOOL WITH A SHARP POINT.
4. CHECK TO MAKE SURE YOU HAVE ENGRAVED ALL LINES. DAMPEN MATT PAPER TO BE PRINTED, ABOUT 20 MINUTES BEFORE USING.
5. INK THE PLATE USING WATER BASE PRINTERS INK REDUCED WITH WATER, NOT OIL. REPLACE INK LID IMMEDIATELY.
6. PRINT THE PLATE: USING MATT PAPER ABOUT 1" LARGER THAN PLATE AND ABOUT 1/4" THICK NEWSPAPER PADDING ON EACH SIDE, RUN THIS THROUGH THE SHEET METAL SLIP ROLL. MAKE 3 GOOD PRINTS, ONE FOR NOTEBOOK, ONE TO TAKE HOME AND ONE FOR THE SCHOOL. CLEAN PLATE AFTER EACH PRINT WITH WATER.
7. CLEAN AND PUT AWAY ALL MATERIALS.

REFERENCES:

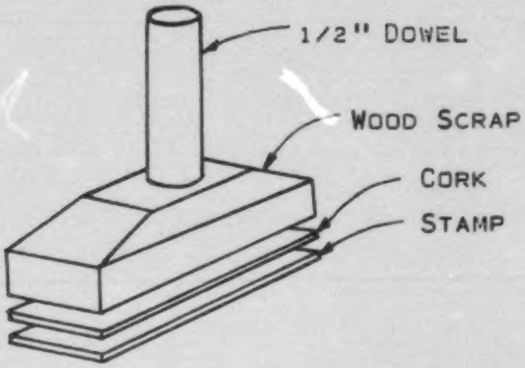
2.



TITLE: NAME AND ADDRESS STAMP

COST: ____________

SKETCH:



MATERIAL:

1/2" Dowel 3 1/2" Long
Wood Scrap
Cork
Elmers Glue
Rubber Cement
Stamp Rubber

TOOLS & EQUIPMENT: Dovetail Saw, Scissors, Printers Type, Chase, Spacers, 1/2" Twist Drill, Drill Press

PROCEDURES:

1. Print the name and address that you want on a piece of paper.
2. Lock type up in center of chase.
3. Slide the chase into the rubber stamp press, and preheat the type form to 300° F. for two minutes.
4. Pull type out of press, put bakelite over type and a piece of paper over bakelite.
5. Insert type into oven to make mold.
6. Raise bid until first resistance is felt. Let sit for one minute.
7. Raise press to the stops on the chase and let bake for ten minutes.
8. Lower the bid of the press, remove chase and mold and carefully pry matrix from type.
9. Use caution because the chase, type and form are extremely hot and could cause severe burns.
10. Cut a piece of stamp rubber that is 1/8" larger on all sides.
11. Dust matrix and stamp rubber with soapstone and remove all excess soapstone powder from the matrix cavities.
12. Place matrix face up on vulcanizing tray, place stamp rubber over matrix and cover back of stamp rubber with a piece of paper.
13. Place tray in oven, raise bed of the press and bake for six minutes to vulcanize gum.
14. Remove tray from oven and let cool. Be careful not to burn yourself.

REFERENCES:

NAME AND ADDRESS STAMP (CONTINUED)

15. STRIP OFF VULCANIZED RUBBER AND CUT OFF EXCESS RUBBER BY TAPERING AWAY FROM THE RAISED PRINTING SURFACE.

16. CUT DOWEL 3 1/2" LONG AND WOOD SCRAP THE SIZE OF STAMP.

17. CUT CORK THE SAME SIZE AS THE STAMP.

18. DRILL 1/2" HOLE IN WOOD SCRAP 1/2" DEEP ON DRILL PRESS.

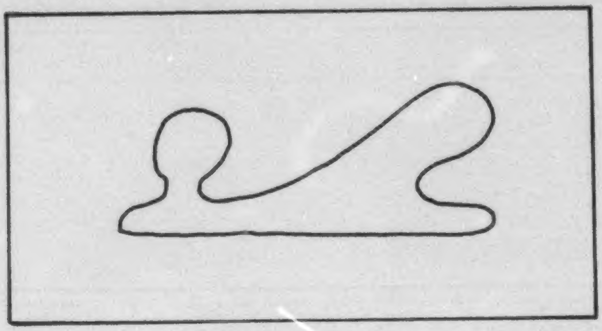
19. GLUE IN DOWEL AND GLUE ON CORK WITH ELMERS GLUE.

20. GLUE ON STAMP WITH RUBBER CEMENT.

TITLE: STENCIL PRINTING

COST: ______

SKETCH:



MATERIAL:

THIN SHOE BOX CARDBOARD FROM HOME

PAINT - SPRAY CAN

MATERIAL TO PRINT ON - WOOD, METAL, PAPER

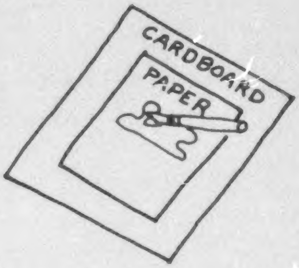
TOOLS & EQUIPMENT: TAPE, SCISSORS, PAPER TOWELS, X-ACTO KNIFE, NEWSPAPER, UTILITY KNIFE

PROCEDURES:

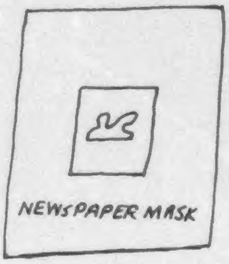
1. PREPARE DESIGN IN FULL SIZE ON PAPER.
2. CUT OUT INSIDE OF DESIGN, CENTER PAPER WITH CUT OUT DESIGN ON THE CARDBOARD AND TRACE AROUND THE INSIDE OF DESIGN ONTO CARDBOARD.
3. REMOVE PAPER AND CAREFULLY CUT OUT INSIDE OF DESIGN THAT IS ON THE CARDBOARD. USE AN X-ACTO KNIFE, UTILITY KNIFE, OR SCISSORS. YOU WANT TO HAVE A GOOD SHARP EDGE. DO NOT PUT A BEND IN THE CARDBOARD. CUT ON A CUTTING BOARD, NOT TABLE TOP.
4. PRINT DESIGN ON DESIRED MATERIAL. TAPE CARDBOARD STENCIL TO TABLE TOP OR TO MATERIAL TO BE PRINTED. SPREAD A LARGE NEWSPAPER MASK AROUND AND UNDER CARDBOARD STENCIL TO PROTECT MATERIAL TO BE PRINTED AND WORK AREA. WEIGHT STENCIL WITH PIECE OF WOOD IF IT WILL NOT LAY FLAT. SPRAY PAINT STENCIL DESIGN. FOLLOW DIRECTIONS ON SPRAY CAN. SELECT COLOR FROM STOCK IN FINISH ROOM.
5. CHECK LIST FOR CLEAN UP:
   - A. WIPE NOZZEL CLEAN WITH A PAPER TOWEL. READ DIRECTIONS ON CAN AND MAKE SURE YOU INVERT CAN AND SPRAY UNTIL NOZZEL IS CLEAR.
   - B. LIFT NEWSPAPER MASK AND STENCIL FROM PRINTED MATERIAL AND THROW AWAY. SAVE STENCIL IF DESIRED.
   - C. PUT ALL OTHER MATERIALS AND TOOLS AWAY.

REFERENCES:

3.



4.



TITLE: NAME PIN

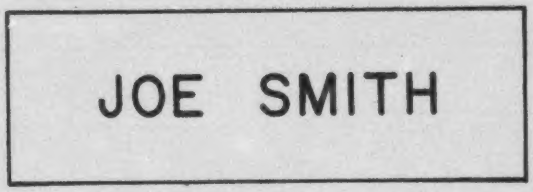
COST: ________

MATERIAL:

1 PIECE OF ENGRAVING PLASTIC 1" X 3"

1 PIN BACK

SKETCH:



TOOLS & EQUIPMENT: PANTOGRAPH, 1/64" BIT, SCROLL SAW, DISC SANDER, EPOXY CEMENT, 400 GRIT ABRASIVE PAPER.

PROCEDURES:

1. SELECT A PIECE OF ENGRAVING PLASTIC 1" X 3". BEVEL THE EDGES AND SAND.
2. MOUNT THE 1/64" BIT IN THE PANTOGRAPH.
3. SELECT THE LETTERS NEEDED TO SPELL YOUR NAME FROM THE JOB CASE AND SET THEM IN THE COPY PLATE.
4. CENTER THE ENGRAVING STOCK USING THE CENTERING SCALE AND BY MOVING THE WORK HOLDER PLATE.
5. START THE MOTOR AND TRACE THE LETTERS WITH THE STYLUS.
6. REMOVE THE ENGRAVED STOCK AND PEEL OFF THE PROTECTIVE COVERING.
7. MOUNT THE PIN BACK ON THE BACK SIDE OF THE ENGRAVED PLASTIC WITH EPOXY CEMENT. LET IT DRY OVERNIGHT

REFERENCES:

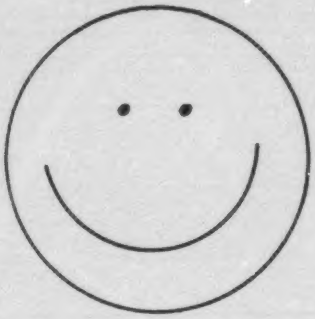
TITLE: ENGRAVED PIN

COST: __________

MATERIAL: 1 PIN BACK

1 PC. ENGRAVING PLASTIC,
APPROX. 1 1/2" SQUARE

SKETCH:

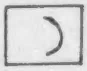


TOOLS & EQUIPMENT: PANTOGRAPH, .060 BIT, BANDSAW, STATIONARY SANDER, DUCO CEMENT, UTILITY KNIFE.

PROCEDURES:	REFERENCES:

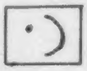
1. SELECT OR CUT A PIECE OF ENGRAVING PLASTIC APPROX. 1 1/2" SQUARE.
2. SELECT .060 BIT FOR PANTOGRAPH AND MOUNT IN CUTTER.
3. SELECT LARGE "O" FROM LARGE ALPHABET AND SET IN COPY TYPE HOLDER.
4. SELECT A "PERIOD" OR "DOT" TO BE USED FOR EYES AND SET IN COPY TYPE HOLDER.
5. SET PLASTIC IN VICE MATERIAL HOLDER.
6. LINE UP MATERIAL SO SMILE CAN BE CUT FROM 1/2 THE "O". CUT WITH PANTOGRAPH.

   EXAMPLE

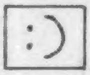
7. NOW CUT ONE EYE.

   EXAMPLE

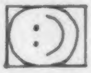
8. CUT OTHER EYE. BE CAREFUL YOU HAVE THE SAME SPACING AS THE FIRST EYE.

   EXAMPLE

9. TRACE CIRCLE OVER FACE.

   EXAMPLE

10. SAND TO CIRCLE LINE ON STATIONARY SANDER.
11. MOUNT PIN ON BACK WTIH DUCO CEMENT. BE SURE TO SCRAPE AREA TO BE CEMENTED. MUST DRY 24 HOURS.

TITLE: CALLING CARD

COST: ____________

SKETCH:

PLASTICS UNLIMITED
22815 PACIFIC HIGHWAY SOUTH

MATERIAL:

BLANK CARD (CUT YOUR OWN TO SIZE)

INK

TOOLS & EQUIPMENT: PLATEN PRESS AND ACCESSORIES, TYPE AND ACCESSORIES, INK AND ACCESSORIES, PAPER CUTTER, STRING, SOLVENT, PAPER TOWELS, RAGS, SPATULA.

PROCEDURES:

1. PLAN LAYOUT AND SPACING.
2. STUDY LAYOUT OF CALIFORNIA JOB CASE.
3. SELECT TYPE TO BE USED.
4. SET TYPE FOR CARD.
5. TIE UP TYPE AND TAKE PROOF.
6. PROOF READ.
7. LOCK TYPE UP IN A CHASE. BEFORE YOU GO FURTHER, READ AND STUDY CH. 3, PAGE 29, GRAPHIC ARTS BY CARLSEN AND PRINTERS GUIDE BOOK, PAGE 10, 13, 16, 18.
8. READY PRESS. DO THIS AT THE START OF A PERIOD, SO YOU WILL HAVE TIME TO PRINT AND CLEAN THE PRESS.
9. PRINT COPY.
10. CLEAN PRESS AND TYPE. WHEN YOU FINISH, HAVE INSTRUCTOR CHECK PRESS.
11. UNLOCK AND DISTRIBUTE TYPE.
12. CLEAN UP AND PUT THINGS AWAY.

REFERENCES:

TITLE: BUSINESS CARD

COST:

MATERIAL: CARDS

INK

SKETCH:

SIDEWALKS & DRIVEWAYS

SHOVELED

ODD JOBS

John Smith phone 483-6412

TOOLS & EQUIPMENT: PILOT LETTER PRESS, COMPOSING STICK, CHASE, TYPE, GAUGE PINS, SOLVENT, PAPER TOWELS, RAGS, LACQUER THINNER, BRUSH

PROCEDURES:

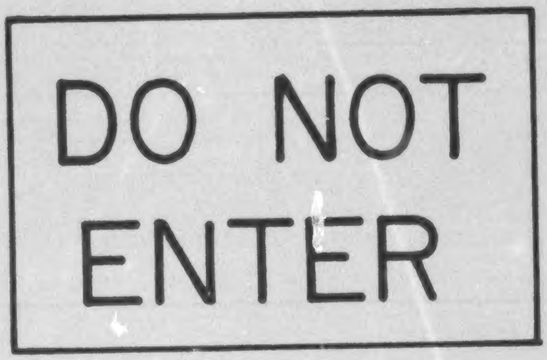
1. PLAN LAYOUT AND SPACING.
2. CHOOSE TYPE FACE TO BE USED.
3. SET TYPE - SEE MACHINE OPERATION NOTEBOOK.
4. LOCK IN CHASE AND PROOF.
5. MAKE READY THE PRESS. THIS MUST BE DONE AT THE BEGINNING OF THE PERIOD. CHECK INSTRUCTION SHEET.
6. PRINT - SEE MACHINE OPERATION NOTEBOOK.
7. CLEAN UP AS LISTED ON INSTRUCTION SHEET.

REFERENCES:

TITLE: POSTER CARD OR SIGN

COST: ______

SKETCH:



MATERIAL:

CARDBOARD 7" X 11" OR
11" X 14"

TOOLS & EQUIPMENT: SIGNPRESS, TYPE, BRAYER, INK

PROCEDURES:

1. READ AND KNOW THE "4" BASIC FUNCTIONS OF OPERATING AND CLEANING THE SIGNPRESS.

2. SET UP TYPE ON BED OF SIGNPRESS.

3. ROLL OUT INK ON INKBOARD AND APPLY TO FACE OF TYPE.

4. INSERT PAPER OR CARDBOARD UNDER GRIPPERS AT ANCHOR CORNER.

5. BRING PRESSURE ROLLER TO GRIPPER END OF MACHINE WITH PRESSURE HANDLE UP. NOW MOVE PRESSURE ROLLER ABOUT 1" TOWARD TYPE AND LOWER PRESSURE HANDLE TO PRINTING POSITION. NOW ROLL PRESSURE ROLLER OVER TYPE TO OTHER END OF MACHINE AND RAISE PRESSURE HANDLE UP.

6. LIFT PAPER OR CARDBOARD WITH RIGHT HAND OFF TYPE SLOWLY AND REMOVE FROM GRIPPERS WITH LEFT HAND.

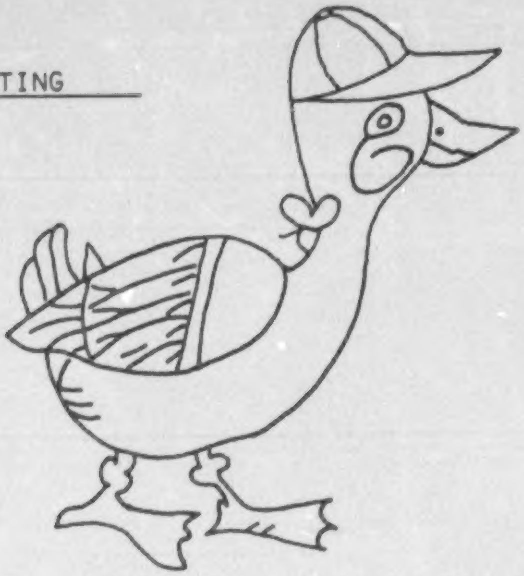
7. CLEAN UP.

REFERENCES:

TITLE: BLOCK PRINTING

COST:

SKETCH:



MATERIAL: WOOD BLOCK
LINOLEUM BLOCK
SANDPAPER
INK
PAPER

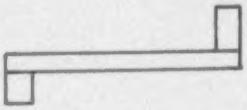
TOOLS & EQUIPMENT: 1/64" VEINING TOOL, 1/8" GOUGE, 3/16" GOUGE, 1/4" GOUGE, CARBON PAPER, UTILITY KNIFE, X-ACTO KNIFE, BENCH HOOK, WOOD CARVING TOOLS, WOOD CLAMP, CONTACT CEMENT, BRAYER, INK PLATE.

PROCEDURES:

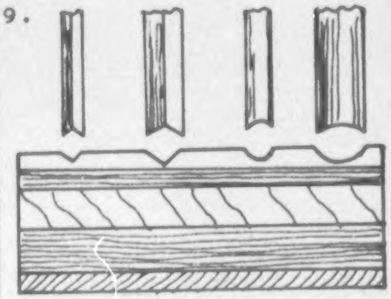
1. DRAW YOUR DESIGN ON TRANSPARENT PAPER SUCH AS TRACING PAPER.
2. LINOLEUM IS USUALLY WAXED. REMOVE THIS WAX BY SCRAPING, OR EXTREMELY FINE SANDPAPER. CONTACT CEMENT THE LINOLEUM TO A BLOCK OF WOOD.
3. PLACE A PIECE OF CARBON PAPER OVER THE LINOLEUM BLOCK, THEN THE DESIGN FACE DOWN ON THE CARBON PAPER.
4. TAPE THIS ASSEMBLY TO THE BLOCK SO IT WILL NOT MOVE.
5. TRACE THE DESIGN ONTO THE BLOCK.
6. EXAMINE THE TRANSFER CAREFULLY AND TOUCH UP ANY AREA WHICH IS NOT CLEAR.
7. A BENCH HOOK IS USED TO HOLD THE BLOCK WHILE CUTTING.
8. FIRST, OUTLINE THE DESIGN WITH A V-SHAPED VEINING TOOL.
9. USE A GOUGE TO REMOVE THE LARGE PORTIONS THAT ARE TO BE CUT AWAY.
10. USE EXTREME CARE IN CUTTING THE BLOCK, IT IS NOT PRACTICAL TO FILL.
11. ALWAYS CUT AWAY FROM YOUR BODY AND HANDS.
12. THE BLOCK IS CUT IN A MANNER THAT WILL PROVIDE A BEVEL FROM THE PRINTING SURFACE OUTWARD.
13. USE A BRAYER AND INK PLATE FOR INKING THE BLOCK, THEN APPLY PRESSURE OF LINOLEUM BLOCK TO PAPER TO MAKE A PRINT.

REFERENCES:

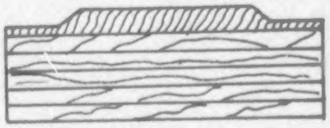
7.



9.



12.



14. CLEAN INK PLATE AND BRAYER.

INFORMATION SHEET - THERMOGRAPHY

THERMOGRAPHY, SOMETIMES REFERRED TO AS "FRIED" PRINTING, IS EMPLOYED TO SIMULATE ENGRAVING. IT IS, THEREFORE, KNOWN AS IMITATION ENGRAVING. THIS PROCESS RAISES THE PRINTED SURFACE BY HEATING A SPECIAL POWDER DUSTED ONTO WET INK.

PROCEDURE:

PROCESS STEPS NUMBERED BELOW SHOULD BE WRITTEN ON PLAN SHEET AND COST ENTERED ON PROPER PAGE. COSTS WILL VARY IN MULTIPLES OF 5¢. YOU ARE TO USE YOUR OWN JUDGMENT ABOUT THE COST AND THEN CALL THIS TO THE INSTRUCTOR'S ATTENTION WHEN YOU GET YOUR PLAN SHEET APPROVED.

PRESENT PLAN SHEET TO INSTRUCTOR FOR APPROVAL. BE SURE THE WORDS FOR YOUR SIGN ARE SPELLED CORRECTLY.

1. AFTER APPROVAL, PRINT YOUR SIGN.
2. PLACE NEWLY PRINTED SIGN OVER A CLEAN SHEET OF PAPER, LARGER THAN YOUR SIGN.
3. SELECT THE PROPER COLOR POWDER (SILVER OR GOLD).
4. CAREFULLY SPRINKLE POWDER ON LETTERS THAT YOU DESIRE TO RAISE. COVER THEM THOROUGHLY. POWDER WILL STICK TO ANY WET INK AND MISTAKES CANNOT BE CORRECTED.
5. LIFT SIGN AND DUMP ALL EXCESS POWDER ONTO CLEAN SHEET UNDER SIGN. BRUSH OFF ANY POWDER THAT IS NOT DESIRED WITH SMALL BRUSH.
6. DUMP THIS POWDER BACK INTO PROPER CONTAINER. ALWAYS HAVE A CLEAN SHEET OF PAPER UNDER CONTAINER. THIS POWDER IS EXPENSIVE. BE VERY CAREFUL THAT NO DIRT IS MIXED WITH THE POWDER. BE VERY CAREFUL THAT ALL THE EXCESS POWDER GETS BACK INTO THE CONTAINER.
7. COVER EYES WITH COLORED GOGGLES OR WELDING GOGGLES, OR SUN GLASSES.
8. TURN ON HEAT LAMP.
9. HOLD SIGN APPROXIMATELY 3 INCHES FROM HEAT LAMP AND MOVE SIGN BACK AND FORTH. YOU WILL SEE THE POWDER CHANGE TO A LIQUID AND FLOW TOGETHER DUE TO THE HEAT FROM THE LAMP. (APPROXIMATELY 3 OR 4 MINUTES).
10. REMOVE SIGN FROM HEAT SOURCE AND ALLOW LIQUID TO HARDEN. THREE OR FOUR MINUTES, USUALLY.
11. TURN OFF HEAT LAMP.
12. REPLACE GOGGLES AND OTHER EQUIPMENT TO ITS PROPER PLACE.
13. CLEAN SIGN PRESS AREA.
14. SHOW PROJECT TO APPROVING INSTRUCTOR.

TITLE: MIXING ULTRACAL 30 AND HYDROCAL 811

COST: ______

MATERIAL: ULTRACAL - GREEN
HYDROCAL

SKETCH:

SKETCH OF PROJECT

TOOLS & EQUIPMENT: MIXING TUB, MOLDS

PROCEDURES:

REFERENCES:

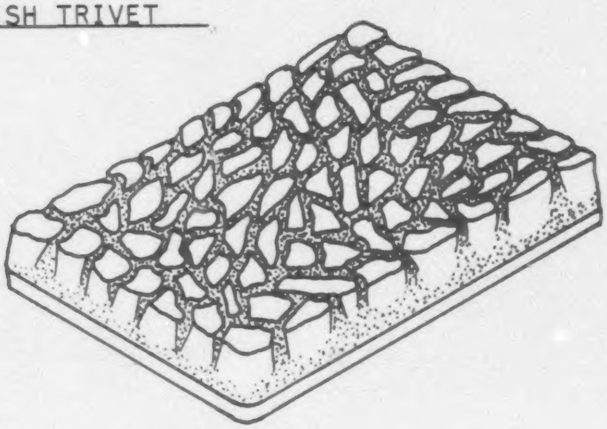
1. FILL MOLD YOU WANT TO CAST WITH WATER, THEN DUMP WATER INTO THE MIXING TUB. THIS WILL TELL YOU HOW MUCH WATER YOU NEED FOR YOUR CASTING PROJECT.
2. ADD THE HYDROCAL MATERIAL TO THE WATER SLOWLY, MIX WELL AND CONTINUE TO ADD MATERIAL UNTIL IT BECOMES CREAMY. THE DRYER THE MIX, THE STRONGER IT WILL BE.
3. WHEN THE BATCH IS READY, PUT INTO THE LOWEST CORNER OF THE MOLD OR FLASK. ALLOW THE MATERIAL TO FLOW DOWN INTO THE CAVITY. THIS WILL KEEP OUT AIR VOIDS WHICH COULD SPOIL YOUR WORK.
4. SHAKE OR VIBRATE THE MOLD. THIS WILL REMOVE TRAPPED AIR BUBBLES WITHIN THE MATERIAL.
5. AS THE MATERIAL IS DRYING OR SETTING, IT WILL GIVE OFF SOME HEAT. THE SETTING TIME VARIES ACCORDING TO MIX, TEMPERATURE, HUMIDITY, ETC. UNDER AVERAGE CONDITIONS, IT TAKES 20-25 MINUTES FOR HYROCAL AND 25-35 MINUTES FOR ULTRACAL.
6. BE SURE TO CLEAN THE MIXING POT AND STIRRING STICK AND RETURN EVERYTHING TO ITS PROPER LOCATION.

NOTE: THESE TWO PATTERN MAKING MATERIALS ARE HIGH STRENGTH PLASTERS USED IN TOOL DESIGN, PATTERN SHOP WORK AND PLASTIC MOLD DEVELOPMENT. THE PLASTER GETS ITS STRENGTH BY THE DEVELOPMENT OF NEEDLE-LIKE CRYSTALS WHICH BECOME TIGHTLY INTERLACED. AS MORE WATER IS ADDED TO THE MIX, THE CRYSTALS ARE DRIVEN FARTHER APART, PRODUCING A WEAKER CASTING. FOR EXAMPLE, IF 90 POUNDS OF WATER IS ADDED TO 100 POUNDS OF DRY PLASTER, THE CASTING WOULD HAVE A COMPRESSIVE STRENGTH OF 1500 POUNDS PER SQUARE INCH. IF 30 POUNDS OF WATER WERE ADDED TO IT, IT WOULD HAVE A COMPRESSIVE STRENGTH OF 12,000 POUNDS PER SQUARE INCH.

TITLE: HOT DISH TRIVET

COST: ________

SKETCH:



MATERIAL: CERAMIC TILE
GROUT
CERAMIC TILE ADHESIVE
1/8" MASONITE

TOOLS & EQUIPMENT: SAW (TABLE, HAND OR BAND), BELT SANDER, PUTTY KNIFE

PROCEDURES:

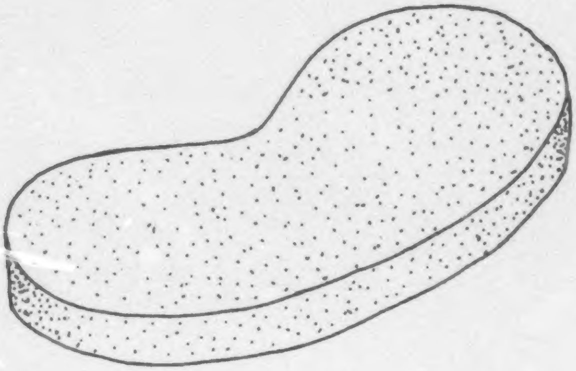
1. DETERMINE SHAPE, SIZE AND DESIGN OF TRIVET.
2. CUT PIECE OF 1/8" MASONITE TO SHAPE AND SAND EDGES.
3. SELECT AND LAY OUT PIECES OF TILE TO THE DESIGN YOU WANT ON PIECE OF MASONITE. (CUT PIECES OF TILE IF YOU NEED TO, WITH TILE CUTTER.)
4. APPLY CERAMIC TILE ADHESIVE TO ROUGH SIDE OF MASONITE. MAKE ABOUT AS THICK AS A HEAVY COAT OF PAINT.
5. PLACE TILE IN PRE-DETERMINED DESIGN AND PUSH FIRMLY INTO PLACE.
6. LET DRY OVERNIGHT.
7. MIX ABOUT 1/3 CUP OF GROUT AS DIRECTED ON DRI SET GROUT BOX.
8. RUB GROUT OVER ENTIRE DESIGN AND PRESS FIRMLY INTO CRACKS. (THE HAND IS THE BEST TOOL.)
9. REMOVE EXCESS GROUT AND WIPE CLEAN WITH A PAPER TOWEL.
10. POLISH WITH A RAG.
11. SAND EDGES AND BACK OF MASONITE.
12. APPLY TWO COATS OF SANDING SEALER TO BACK OF FINISHED TRIVET (ON MASONITE BACKING).

REFERENCES:

TITLE: CONCRETE STEPPING STONE

COST: ________

SKETCH:



MATERIAL: CEMENT
SAND
GRAVEL

TOOLS & EQUIPMENT: METAL STEPPING STONE FORM, MIXING BOX, SHOVEL, WOODEN FLOAT AND FINISHING TROWEL, MIXING HOE

PROCEDURES:

1. MAKE SURE FORM IS BOLTED TOGETHER PROPERLY AND PLACE ON A FLAT, OILED PLYWOOD BOARD.
2. MEASURE 3 PARTS SAND, 3 PARTS GRAVEL AND 1 PART CEMENT IN MIXING BOX AND THOROUGHLY MIX. GRADUALLY ADD SMALL AMOUNTS OF WATER, MIXING THOROUGHLY UNTIL A MEDIUM CONSISTENCY IS REACHED (LIKE A THICK MILKSHAKE).
3. POUR MIX INTO MOLD AND STRIKE OFF LEVEL WITH STRIKE BOARD, WORK WITH WOODEN FLOAT.
4. AS THE CONCRETE BEGINS TO HARDEN (APPROXIMATELY 30 TO 45 MINUTES) COMPLETE FINAL TROWELING WITH STEEL TROWEL.
5. AFTER THE CONCRETE HAS CURED OVERNIGHT, REMOVE THE FORM AND HANDLE WITH CARE UNTIL COMPLETELY CURED (7 TO 10 DAYS).
6. CAUTION: DO NOT WORK CONCRETE WITH HANDS, AS THIS WILL CAUSE THE SKIN TO CHAP AND DRY OUT.

REFERENCES:

MASS PRODUCTION

THE MASS PRODUCTION METHOD OF PRODUCING PROJECTS CAN BE A LOT OF FUN. IT CAN ALSO BE A MORE EFFECTIVE WAY OF MAKING A QUANTITY OF THE SAME ITEM.

THIS PROCESS CAN BE USED IN ANY AREA OF THE SHOP AND ON ANY PROJECTS THAT HAVE TWO OR MORE PARTS.

THE NUMBER OF YOU WHO WISH TO TEAM TOGETHER IS ALSO OPEN. WITH TWO OR MORE PEOPLE, YOU CAN ORGANIZE INTO A PRODUCTION TEAM.

EXAMPLES OF PROJECT IDEAS CAN COME FROM MANY SOURCES. A FEW OF THESE ARE:

1. THE PROJECTS DISPLAYED IN EACH AREA.
2. THE REFERENCE BOOKS.
3. CHRISTMAS TOYS FOR NEEDY CHILDREN.
4. TEACHER'S SUGGESTIONS.
5. YOUR OWN IDEAS.

IF YOU ARE INTERESTED, FOLLOW THE GENERAL STEPS OUTLINED BELOW:

GENERAL PROCEDURES

1. SELECT A PROJECT IDEA.
2. FORM A TEAM OF THOSE PEOPLE WHO ARE INTERESTED.
3. DETERMINE HOW MANY ITEMS YOU WISH TO MAKE.
4. MAKE A COST BREAKDOWN ON THE BACK OF A PLAN SHEET, SO YOU ARE SURE OF THE EXPENSES INVOLVED. (PERHAPS SOME MATERIALS CAN BE OBTAINED THROUGH SOURCES OTHER THAN THE SHOP.
5. AT THIS POINT, DETERMINE IF ALL TEAM MEMBERS CAN AFFORD TO PROCEED. CHECK WITH TEACHER.
6. LOOK AT THE EXAMPLE OF THE "FERRY BOAT" IN THIS NOTEBOOK. THIS IS A SUGGESTED WAY FOR YOUR ORGANIZATION.
7. USE THE FORMS PROVIDED FOR YOU IN THE CABINET UNDER THE "TEAM BOARD" AND DESIGN YOUR SYSTEM.
8. CHECK YOUR DESIGN WITH AN INSTRUCTOR.
9. PROCEED AS PLANNED.

MASS PRODUCTION PROCEDURE

STEP #	OPERATION	COMPLETION CHECK
1.	MAKE A SKETCH OF YOUR ASSEMBLY ON "ASSEMBLY PLAN" FORM.	
2.	NUMBER THE PARTS.	
3.	ASSIGN PART MANUFACTURERS AND ENTER ON THE "PERSONNEL ASSIGNMENT" FORM.	
4.	MAKE A PLAN FOR EACH PART ON THE " PART PLAN" FORM.	
5.	DETERMINE THE NUMBER OF SUB-ASSEMBLIES, ASSIGN ASSEMBLERS, AND ENTER ON THE "PERSONNEL ASSIGNMENT" FORM.	
6.	MAKE A PLAN FOR EACH ON "SUB-ASSEMBLY PLAN" FORM.	
7.	COMPLETE FINAL ASSEMBLY PROCEDURES ON THE " ASSEMBLY PLAN" FORM.	
8.	ASSIGN FINAL ASSEMBLERS AND ENTER ON "PERSONNEL ASSIGNMENT" FORMS.	

ASSEMBLY PLAN

ASSEMBLY NAME Ferry Boat QUANTITY 25

MANUFACTURERS Bill Jones, Carl Smith, Jim Davis, George Johnson and Sam Green

NUMBER OF SUB ASSEMBLIES 2 NUMBER OF PARTS 6 TOTAL COST $1.00

SKETCH

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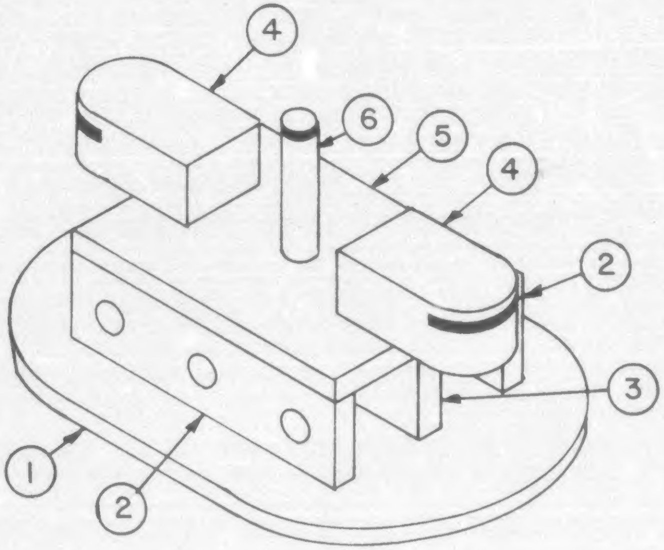


FINAL ASSEMBLY PROCEDURE

STEP NO.	OPERATION
1	Design jig to locate & hold top assembly on the center of the hull for nailing from the bottom.
2	Glue side and divider edges
3	Assemble parts
4	Nail with 4d finish nails & set
5	Fill nail holes
6	Sand as required
7	Paint boat white (2 coats)
8	Trim with black on cabin & smoke stack

PERSONNEL ASSIGNMENTS

ASSEMBLY NAME FERRY BOAT QUANTITY 25

MANUFACTURERS BILL JONES, CARL SMITH, JIM DAVIS, GEORGE JOHNSON & SAM GREEN

NUMBER OF PARTS 6 NUMBER OF SUB-ASSEMBLIES 2 TOTAL COST $25.00

DETAIL PARTS			SUB-ASSEMBLIES			FINAL ASSEMBLY	
PART NO	PART NAME	MANUFACTURER	ASSY. NO.	ASSY. NAME	ASSEMBLER	OPERATION	ASSEMBLER
1	HULL	JONES	1	TOP ASSY.	DAVIS & JOHNSON	1. ASSEMBLE	
2	SIDES	SMITH	2	DECK ASSY.	JONES & SMITH	hull to top	GREEN
3	DIVIDER	DAVIS				2. FILL NAIL HOLES	JONES
4	CABIN	JOHNSON				3. SAND	SMITH
5	DECK	SMITH				4 PAINT	ALL
6	SMOKESTACK	GREEN				5. TRIM	ALL

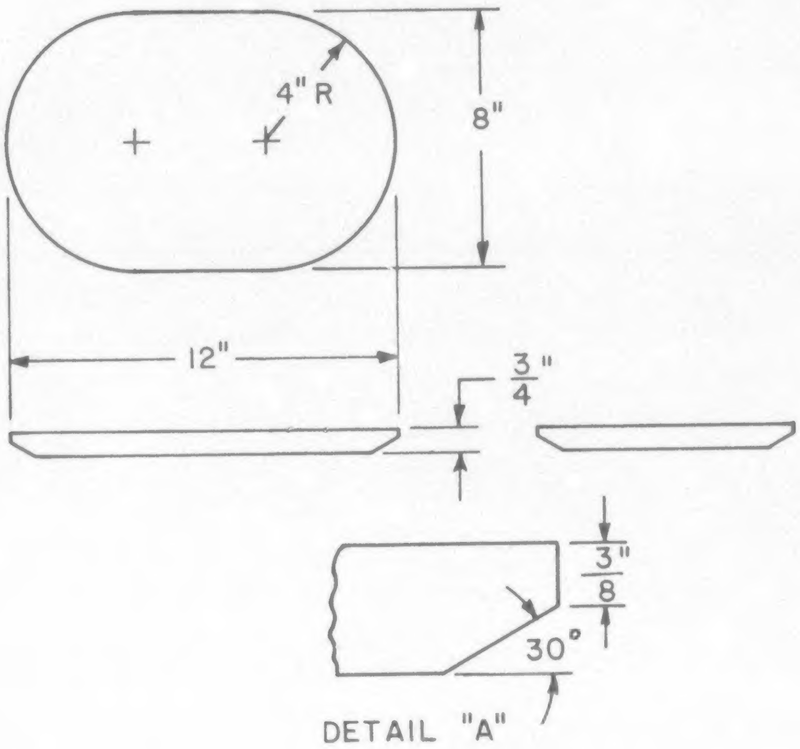
PART PLAN

PART NO. 1 PART NAME HULL QUANTITY 1

MATERIAL PINE SIZE 3/4" x 8" x 12"

MANUFACTURER BILL JONES

PLAN



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PROCEDURE

STEP NO.	OPERATION
1.	CUT 25 PCS OF 3/4" PINE 12" x 8"
2.	FIND CENTER OF RADIUS ON 1 PIECE
3	MARK CIRCLE CUTS
4	CUT ENDS OF HULL
5	USE AS PATTERN FOR THE OTHER 24
6.	SAND ON CHAMFER (SEE DETAIL "A")

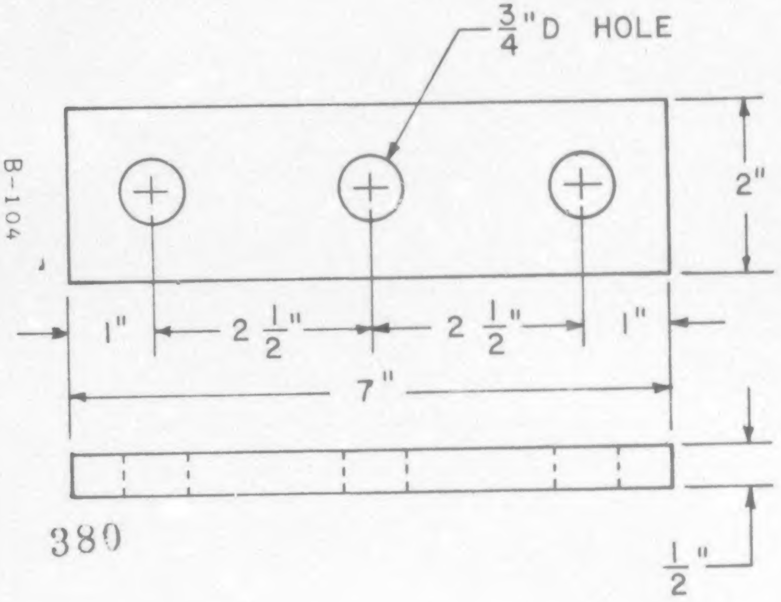
PART PLAN

PART NO. 2 PART NAME Sides QUANTITY 2

MATERIAL Pine SIZE 1/2" x 2" x7"

MANUFACTURER Carl Smith

PLAN



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PROCEDURE

STEP NO.	OPERATION
1	Cut 50 Pcs. For Sides From 1/2 Pine
	2"x7" (Coordinate With Part #3)
2.	Finish All Edges.
3	Drill 3/4" Holes
	(Make Jig To Locate Holes In Parts)

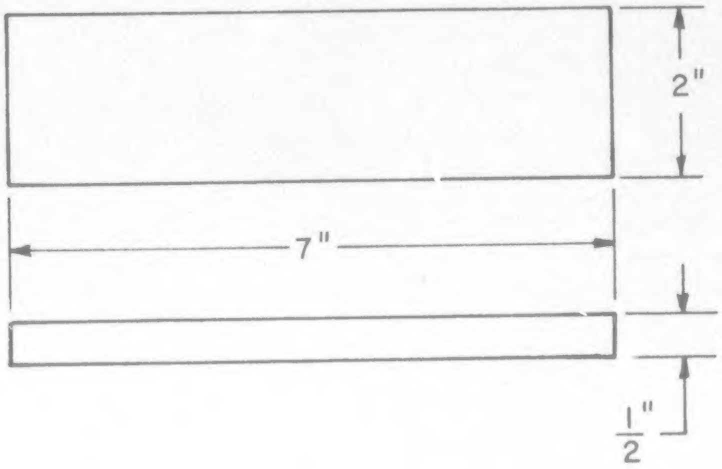
PART PLAN

PART NO. 3 PART NAME DIVIDER QUANTITY 1

MATERIAL PINE SIZE 1/2" x 2" x 7"

MANUFACTURER JIM DAVIS

PLAN



PROCEDURE

STEP NO.	OPERATION
1.	CUT 25 PCS. OF 1/2 PINE 2" x 7"
	(COORDINATE WITH PART #2)
2.	FINISH ALL EDGES

PART PLAN

PART NO. 4 PART NAME CABIN QUANTITY 2

MATERIAL PINE SIZE 1½" x 2" x 3½"

MANUFACTURER GEORGE JOHNSON

PLAN

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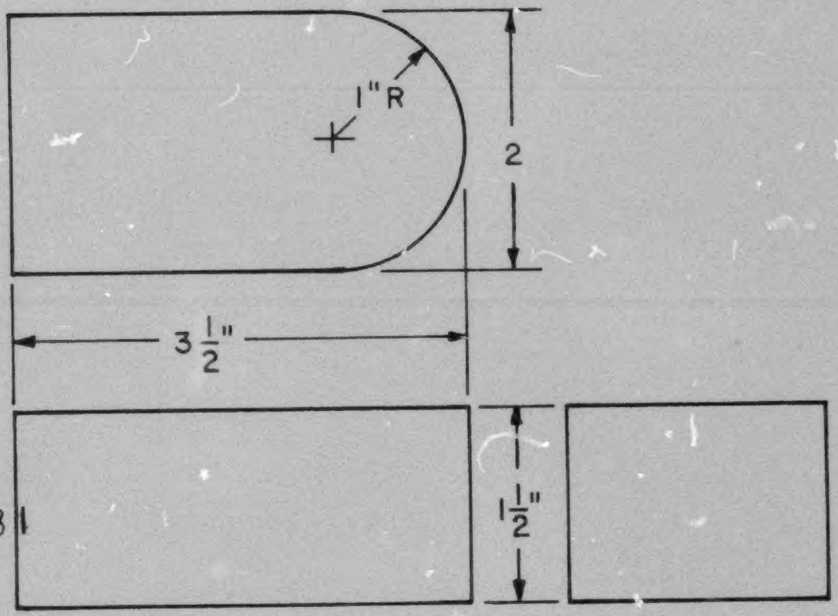

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PROCEDURE

STEP NO.	OPERATION
1.	CUT 50 PCS OF 1½ PINE 2" x 3½"
2.	MAKE TEMPLATE FOR CURVE CUT.
3.	TRACE CURVE CUTS ON CABINS.
4.	CUT CURVE CUTS
5.	SAND

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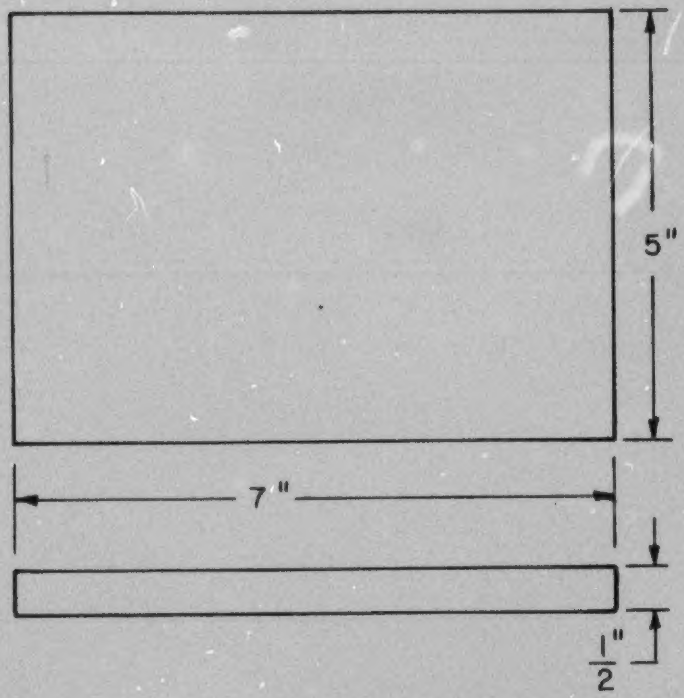
PART PLAN

PART NO. 5 PART NAME DECK QUANTITY 1

MATERIAL PINE SIZE 1/2" x 5" x 7"

MANUFACTURER CARL SMITH

PLAN



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PROCEDURE

STEP NO.	OPERATION
1	CUT 25 PIECES OF 1/2" PINE 5"x7"
2	FINISH ALL EDGES

PART PLAN

PART NO. 6 PART NAME SMOKESTACK QUANTITY 1

MATERIAL 3/4" DOWELING SIZE 3" LONG

MANUFACTURER DAN GREEN

PLAN

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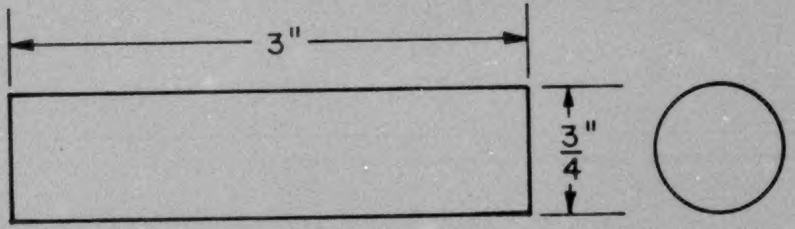

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PROCEDURE

STEP NO.	OPERATION
1.	CUT 25 PIECES OF 3/4" DOWELING 3" LONG *(SET STOP BLOCK ON BANDSAW)
2.	SAND ENDS
	*BE SURE AND CHECK PROCEDURE FOR CUTTING ROUND STOCK

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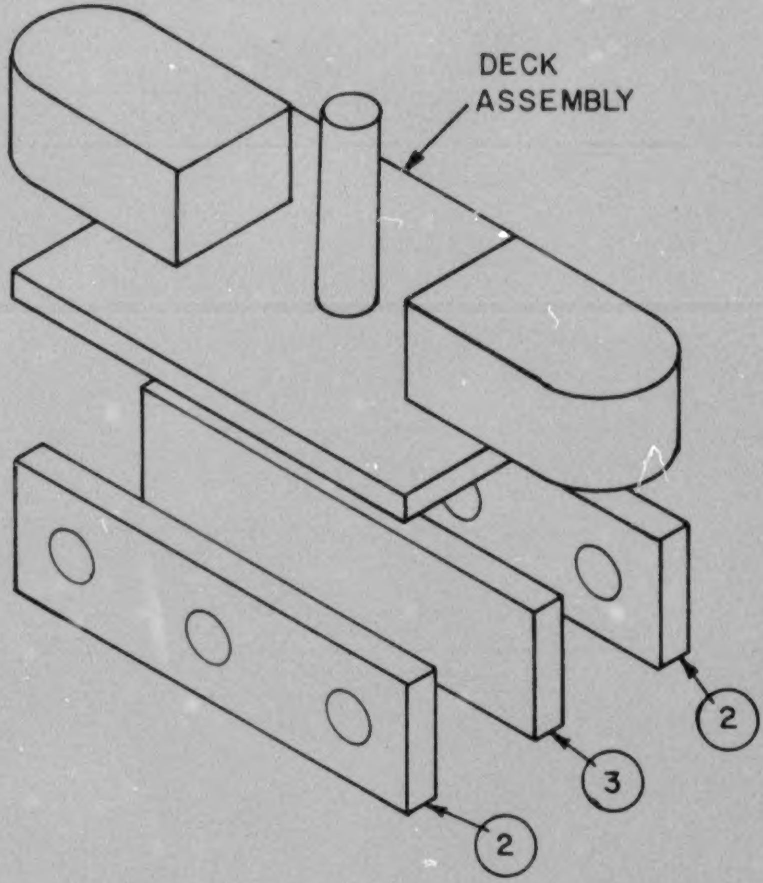
SUB ASSEMBLY PLAN

SUB ASSEMBLY NAME Top Assembly QUANTITY 25

ASSEMBLER Davis & Johnson PART NO'S. (1) Deck Assy (2)#2 (1)#3

SKETCH



B-109

ASSEMBLY PROCEDURE

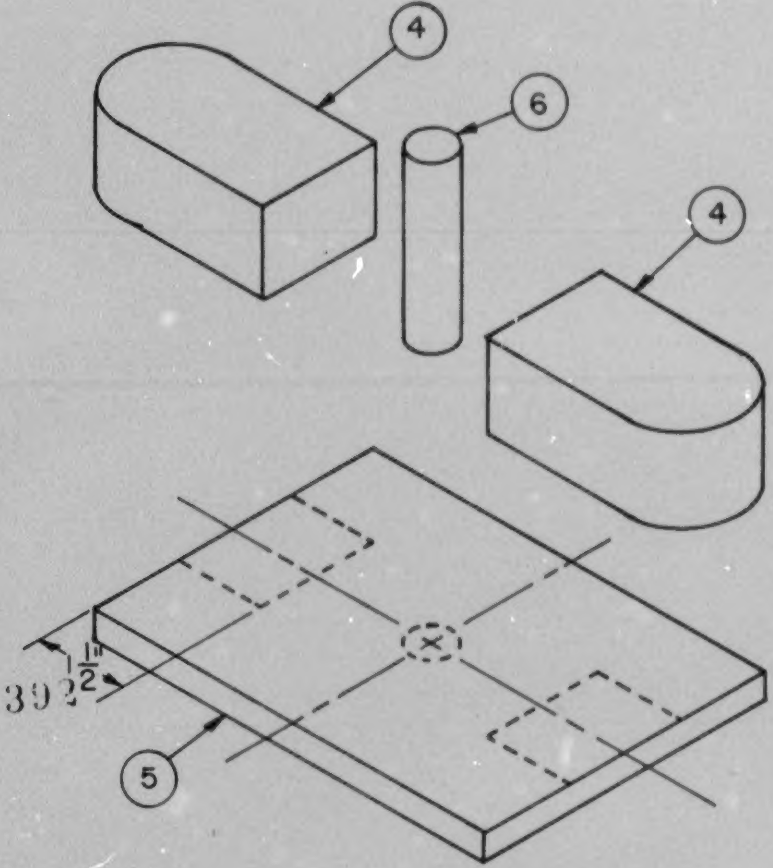
PART NO.	OPERATION
1.	Design jig to locate parts for nailing.
2.	Glue edges of sides & divider.
3.	Assemble Parts
4.	Nail from deck assy. with 2d Finish nails
5.	Set nails
6.	Inspect & Clean

SUB ASSEMBLY PLAN

SUB ASSEMBLY NAME Deck Assembly QUANTITY 25

ASSEMBLER Jones & Smith PART NO'S. (1)#5 (2)#4 (1)#6

SKETCH



ASSEMBLY PROCEDURE

PART NO.	OPERATION
1	Design Jig for locating parts for nailing from bottom
2	Glue bottoms of cabins & smoke stack.
3	Assemble Parts
4	Nail with 2d finishing nails
5	Inspect & Clean

PERSONNEL ASSIGNMENTS

ASSEMBLY NAME ______________________ QUANTITY ______________

MANUFACTURERS ______________________________________

____

NUMBER OF PARTS ____________ NUMBER OF SUB-ASSEMBLIES ____________ TOTAL COST ____________

PART No.	DETAIL PARTS		ASSY. No.	SUB ASSEMBLIES		FINAL ASSEMBLY	
	PART NAME	MANUFACTURER		ASSY. NAME	ASSEMBLER	OPERATION	ASSEMBLER

B-111

PART PLAN

PART NO. ____________ PART NAME ______________________________ QUANTITY ________

MATERIAL ______________________________ SIZE ______________

MANUFACTURER ______________________________

PLAN

B-112

396

PROCEDURE

STEP NO.	OPERATION

397

SUB-ASSEMBLY PLAN

SUB ASSEMBLY NAME ______________________ QUANTITY __________

ASSEMBLER ______________________ PART NOS. ______________________

SKETCH

B-113

ASSEMBLY PROCEDURE

STEP NO.	OPERATION

ASSEMBLY PLAN

ASSEMBLY NAME ____________________ QUANTITY __________

MANUFACTURERS ____________________

____

NUMBER OF SUB-ASSEMBLIES __________ NUMBER OF PARTS __________ TOTAL COST __________

SKETCH

B-114

400

FINAL ASSEMBLY PROCEDURE

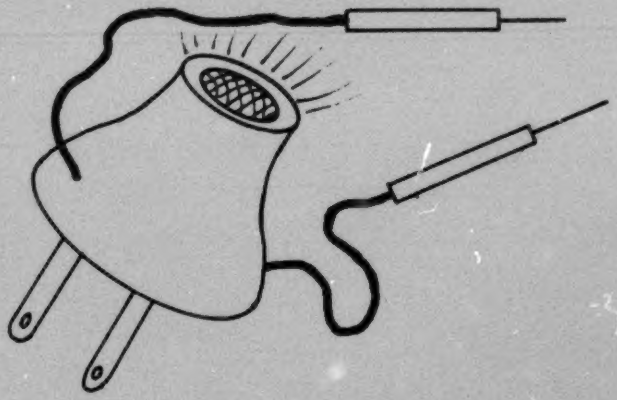
STEP NO.	OPERATION

401

TITLE: CONTINUITY TESTER

COST: ____

SKETCH:



MATERIAL:

1 RUBBER PLUG

1 NE-2 NEON BULB

2 100K 1/2 W RESISTORS

1 3/16 SLICE OF 1/2" DIA ACRYLIC ROD (LENSE)

2-1/16" X 2" BRASS ROD

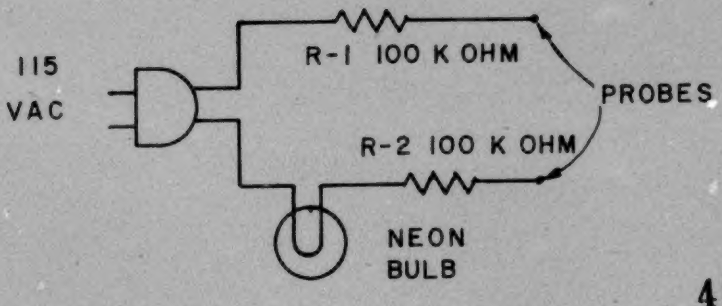
2 STRANDED WIRE LEADS 18" LONG

2 1/4" DIA X 2" ACRYLIC TUBING

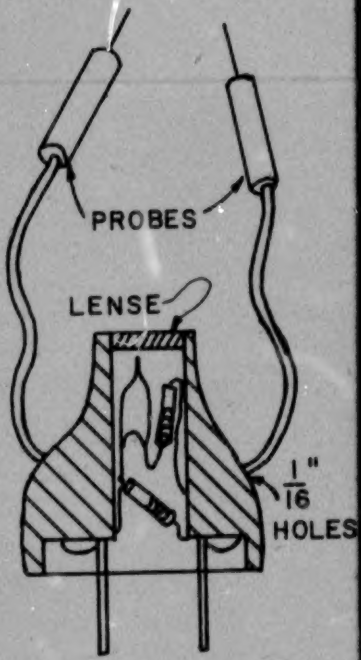
TOOLS & EQUIPMENT: NEEDLE NOSE PLIERS, SMALL SIDE CUTTERS, SOLDERING IRON, DRILL PRESS

PROCEDURES:

1. DRILL 1/16" HOLES ON OPPOSITE SIDES OF PLUG.
2. PUSH LEAD WIRES THROUGH HOLES.
3. SOLDER ONE RESISTOR TO EACH LEAD.
4. SOLDER ONE BULB WIRE TO ONE RESISTOR.
5. SLIP SHORT PIECE OF INSULATION OVER REMAINING BULB WIRE.
6. PLACE BULB AND ONE RESISTOR IN PLUG AS SHOWN IN CROSS SECTION VIEW.
7. ATTACH ONE BULB WIRE TO PLUG SCREW.
8. ATTACH SECOND RESISTOR TO OTHER PLUG SCREW.
9. SOLDER LEADS TO PROBES AND INSERT PROBES INTO HOLE OF 1/4" ACRYLIC TUBING. SECURE WITH PLASTIC CEMENT.
10. INSERT ACRYLIC LENSE DISK IN END OF PLUG AND FASTEN WITH PLASTIC CEMENT.



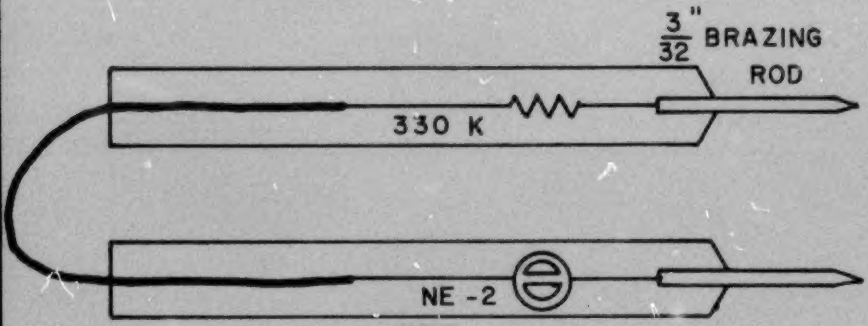
REFERENCES:



TITLE: VOLTAGE CHECKER

COST: ________

SKETCH:



MATERIAL:

2 - BRAZING ROD, 3/32" x 1 5/8" LONG

2 - PLASTIC TUBING TENITE II, 7/16" O.D. 1/32" WALL, 4" LONG

1 - NEON BULB, NE-2

1 - RESISTOR 330K 1/2 W CARBON COMPOSITION

1 1/2' WIRE TEST PROD, 5 KU INSULATION

1 OZ. POLYESTER RESIN & CATALYST

TOOLS & EQUIPMENT: WIRE CUTTER, FILE, SOLDER GUN

PROCEDURES:

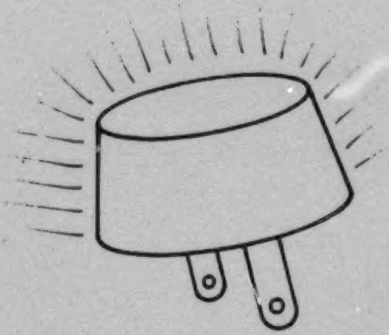
1. CUT 2 - 3/32" BRAZING ROD TO 1 5/8" LENGTH WITH WIRE CUTTER ON METALS TOOL PANEL.
2. TAPER END WITH FILE LIKE SAMPLE.
3. CUT PLASTIC TUBING TO 4" LENGTHS - CUT 2 SMOOTH ENDS.
4. CUT PLASTIC COVERED TEST WIRE 18" LONG.
5. OBTAIN NEON BULB AND RESISTOR FROM INSTRUCTOR.
6. FASTEN ALL PARTS TOGETHER BY TWISTING OR WRAPING.
7. SOLDER CONNECTIONS USING ROSIN CORE SOLDER.
8. PREPARE VOLTAGE TEST JIG BY WAXING THE HOLES THOROUGHLY.
9. INSERT BRAZING ROD INTO SMALL HOLDS IN JIG.
10. WAX OUTSIDE EDGES OF TUBING AND INSERT INTO LARGER HOLES.
11. TAPE TEST LEAD WIRE TO CENTER ROD.
12. MIX 1 OZ. CASTING RESIN WITH 6 DROPS CATALYST.
13. POUR INTO TUBING AND LET SET OVERNIGHT.

REFERENCES:

TITLE: NIGHT LIGHT

COST: ____

SKETCH:



MATERIAL:
1 NE-2 NEON BULB, 1 1/2 WATT, 100 K

RESISTOR

4 OZ. CLEAR CASTING RESIN

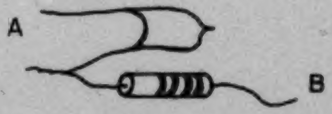
1 FLAT PLUG CAP

TOOLS & EQUIPMENT: SMALL SOLDERING IRON, HEAT SINK, NEEDLE NOSE PLIERS, SIDE CUTTERS, MOLD & JIG FOR CASTING RESIN

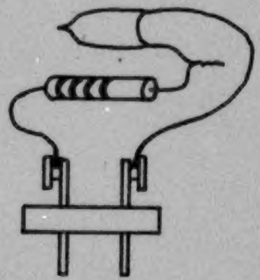
PROCEDURES:

REFERENCES:

1. SOLDER RESISTOR TO ONE LEAD OF NEON BULB.



2. REMOVE AND DISCARD THE RUBBER EXTERIOR OF PLUG CAP.
3. FASTEN LEAD "A" FROM BULB TO ONE SCREW TERMINAL OF PLUG AND FASTEN LEAD "B" FROM RESISTOR TO OTHER SCREW TERMINAL OF PLUG.
4. CAREFULLY SHAPE THIS ASSEMBLY OF BULB AND RESISTOR SO THEY ARE PARALLEL AND NO SHORT CIRCUITS ARE PRESENT.
5. SPRAY INSIDE OF PLASTIC MOLD WITH MOLD RELEASE.
6. SUSPEND THE ENTIRE PLUG ASSEMBLY DOWN INTO THE LAMP MOLD BY SLIDING THE SMALL ROD THROUGH THE HOLES IN THE PLUG PRONGS.



7. MIX THOROUGHLY 4 OZ. OF CASTING RESIN WITH 60 DROPS OF HARDENER IN A SMALL CAN.

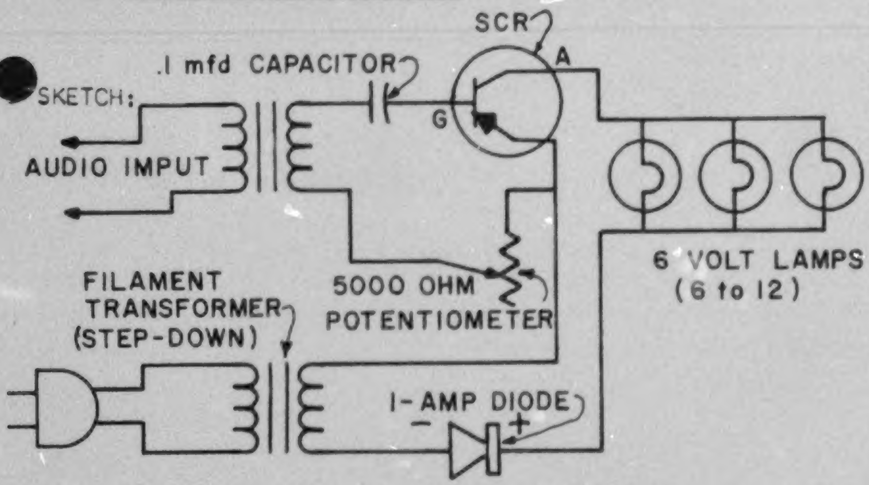
8. CAREFULLY POUR THIS MIXTURE INTO MOLD AND CENTER MOLD AROUND PLUG ASSEMBLY.

9. AFTER RESIN HARDENS (USUALLY IN 30 TO 45 MINUTES), REMOVE PLUG FROM MOLD AND POLISH IN PLASTICS AREA USING WET OR DRY ABRASIVE PAPER AND BUFFERS.

TITLE: 6 VOLT COLOR ORGAN CIRCUIT NO. 4

COST: ____________

SKETCH:



MATERIAL: 5 SHEET METAL SCREWS

1 SCREW, 1-1 AMP DIODE

1 FILAMENT TRANSFORMER

1 AUDIO OUTPUT TRANSFORMER

1 5000 OHN (5K) POTENTIOMETER

1 .1 MFD CAPACITOR

1 LAMP CORD & PLUG

6 TO 12 - 6 VOLT LAMPS & SOCKETS

1 -3/4" X 3" X 6" WOOD

1 FAHNSTOCK CLIP, HOOK-UP WIRE

TOOLS & EQUIPMENT: SOLDERING GUN, SAW, DIAGONAL CUTTERS, SCREW DRIVER

PROCEDURES:

1. SELECT AND CUT TO SIZE A 3/4" X 3" X 6" PIECE OF WOOD SUITABLE FOR MOUNTING COMPONENTS.

2. USING NO. 6 SHEET METAL SCREWS, MOUNT OUTPUT TRANSFORMER 3/4" FROM END OF BOARD WITH WIRE LEADS OF THE SECONDARY WINDING TOWARD THE END. (THESE WIRES ARE USUALLY SMALLER THAN THE PRIMARY AND ARE VARNISH INSULATED).

3. WITH NO. 6 SHEET METAL SCREWS, MOUNT THE FILAMENT TRANSFORMER ON THE OTHER END OF THE BOARD WITH THE PRIMARY LEADS TOWARD THE END. (PRIMARY LEADS ARE NORMALLY BLACK ON THIS KIND OF TRANSFORMER.)

4. SELECT THE .1 MFD CAPACITOR AND SOLDER ONE LEAD TO THE BLUE LEAD OF THE OUTPUT TRANSFORMER.

5. SOLDER THE OTHER LEAD OF THE CAPACITOR TO THE GATE OF THE SCREW.

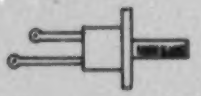
6. SOLDER THE RED LEAD OF THE OUTPUT TRANSFORMER TO THE CENTER LUG OF THE POTENTIOMETER.

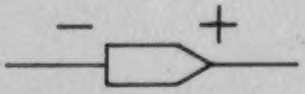
7. SOLDER A 4 1/2" PIECE OF HOOD-UP WIRE TO ONE OF THE OUTSIDE LUGS OF THE POTENTIOMETER. CONNECT THIS WIRE TO THE CATHODE OF THE SCREW. DO NOT SOLDER AT THIS TIME. SEE REFERENCE 5.

8. CONNECT ONE SECONDARY (GREEN) LEAD OF THE FILAMENT TRANSFORMER TO THE CATHODE OF THE SCREW. SOLDER THIS LEAD AND THE ONE PREVIOUSLY CONNECTED THERE.

9. SOLDER THE OTHER SECONDARY LEAD OF THE FILAMENT TRANSFORMER TO THE NEGATIVE LEAD OF THE 1 AMP DIODE.

REFERENCES:





10. WIRE 6 TO 12, 6 VOLT LIGHT SOCKETS IN PARALLEL.

11. CONNECT ONE OF THE LEADS FROM THE LIGHT STRING TO THE POSITIVE END OF THE DIODE AND THE OTHER LEAD TO THE ANODE OF THE SCREW (SEE REFERENCES 5 AND 9).

12. CONNECT EACH CONDUCTOR OF THE LAMP CORD TO ONE OF THE PRIMARY LEADS OF THE FILAMENT TRANSFORMER.

13. CONNECT THE TWO SECONDARY LEADS OF THE OUTPUT TRANSFORMER TO THE SPEAKER LEADS OF A RADIO, RECORD PLAYER, AMPLIFIER OR OTHER AUDIO SOURCE.

14. NEATLY ARRANGE ALL LEADS AND FASTEN WITH SCREWS OR STAPLES AS ON THE SHOP MODEL.

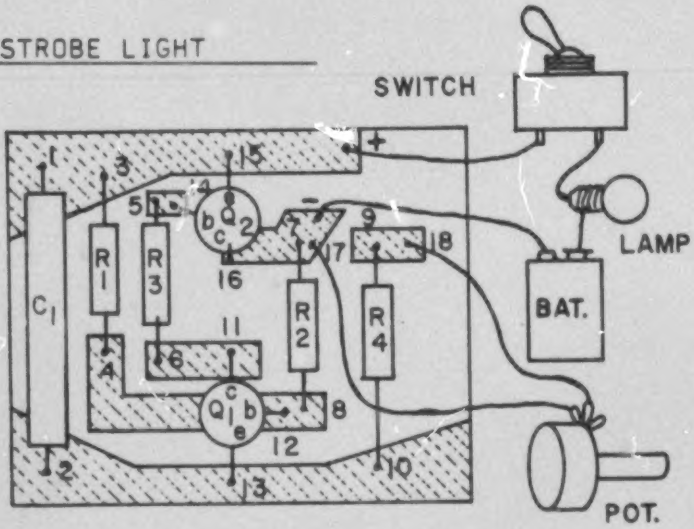
15. WHEN THE CIRCUIT IS PLUGGED IN AND THE RADIO IS TURNED ON, THE LIGHTS SHOULD FLASH IN TIME WITH THE MUSIC.

16. THIS COMPLETES THE ELECTRICAL PART OF THE COLOR ORGAN. FOR THE CABINET PART, USE THE PLAN FOUND IN THE WOOD AREA.

TITLE: STROBE LIGHT

COST: __________

SKETCH:



MATERIAL: 1 CAPACITOR (100UF)

4 RESISTORS (10K.3.9K.300 100 OHM)

2 TRANSISTORS (NPN-Q1.PNP-Q2)

1 SPST SWITCH

1 6 VOLT LIGHT & HOLDER

1 5K POTENTIOMETER

1 PRINTED CIRCUIT BOARD

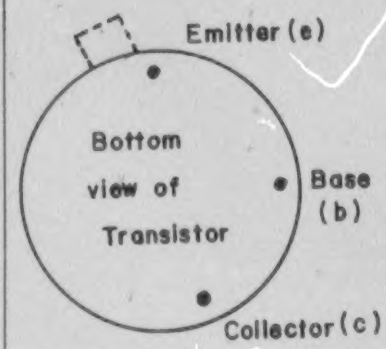
WIRE AND SOLDER

TOOLS & EQUIPMENT: Soldering Iron, Diagonal Clippers, Heat Sink, Needle Nose Pliers

PROCEDURES:

1. Mount the electrolytic capacitor (C1) in holes 1 & 2. Positive end goes in hole 1. Solder leads to copper side of board and clip the excess leads 1/4" from the board.
2. Mount the 10,000 ohm resistor (R1) in holes 3 & 4. Solder and clip.
3. Mount the 3,900 ohm resistor (R2) in holes 7 & 8. Solder and clip.
4. Mount the 300 ohm resistor (R3) in holes 5 & 6. Solder and clip.
5. Mount the 100 ohm resistor (R4) in holes 9 & 10. Solder and clip.
6. Mount the (Q1) transistor in holes 11, 12 and 13. Make sure the base (B) goes in 23, the collector (C) into 11, and the emitter (E) into 13. Solder and clip but use a heat sink when soldering.
7. Mount the (Q2) transistor in holes 14, 15 and 16. Make sure the base goes in 14, the emitter in 15, and the collector in 16. Solder using the heat sink.
8. Strip 1/4" ends of two brown wires. Solder to holes 17 & 18.
9. Cut three pieces of red wire and 1 piece of black wire the length needed to fit your box. Strip the ends of red and black wires.
10. Solder the black wire to negative (-) hole, and one red wire to positive (+) hole.
11. Solder the red wire to one terminal of the switch. Solder another red wire to other terminal of the switch and one terminal of light holder.

REFERENCES:



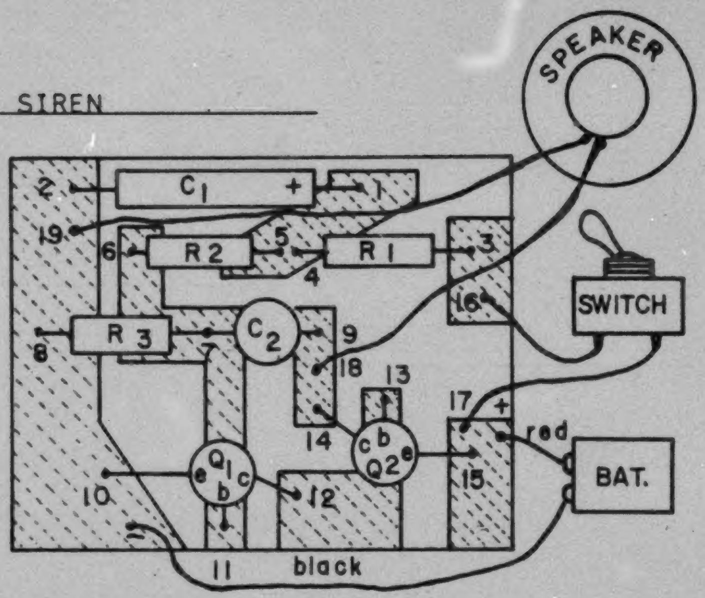
STROBE LIGHT (CON'T)

12. SOLDER REMAINING RED WIRE TO OTHER TERMINAL OF LIGHT HOLDER.
13. CONNECT THE RED WIRE TO THE POSITIVE TERMINAL OF THE BATTERY AND THE BLACK WIRE TO THE NEGATIVE. PLUG IN THE LIGHT, THE STROBE LIGHT IS READY TO TEST.
14. DESIGN A BOX TO HOLD STROBE LIGHT IF DESIRED.

TITLE: SIREN

COST: ________

SKETCH:


SPEAKER
C1
+
R2
R1
R 3
C2
Q1
Q2
e
b
c
SWITCH
BAT.
red
black
+
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

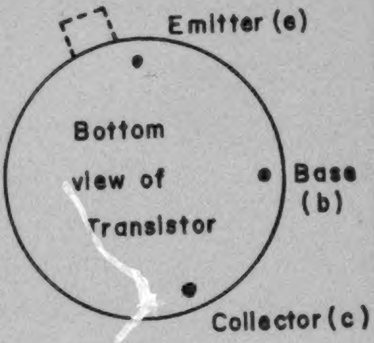
MATERIAL: 1 BATTERY
1 BATTERY CLIP
2 CAPACITORS (25UF 7.04 UF)
2 TRANSISTORS (NPN-Q1.PNP-Q2)
3 RESISTORS 24K, 39K, 47K
1 SPSI SWITCH
1 PHM SPEAKER
1 PRINTED CIRCUIT BOARD
WIRE AND SOLDER

TOOLS & EQUIPMENT: SOLDERING IRON, NEEDLE NOSE PLIERS, DIAGONAL CLIPPERS, HEAT SINK

PROCEDURES:

1. BENT THE LEADS OF THE ELECTROLYTIC CAPACITOR USING NEEDLE NOSE PLIERS TO FIT HOLES 1 & 2. PLACE THE POSITIVE (+) END IN HOLE 1. SOLDER AND CLIP EXCESS LEADS.
2. MOUNT THE 24,000 OHM RESISTOR (R1) IN HOLES 3 & 4 SOLDER.
3. MOUNT THE 39,000 OHM RESISTOR (R2) IN HOLES 5 & 6 SOLDER.
4. MOUNT THE 47,000 OHM RESISTOR (R3) IN HOLES 7 & 8 SOLDER 8 BUT NOT 7.
5. MOUNT THE DISC CAPACITOR (C2) IN HOLES 7 & 9, SOLDER.
6. MOUNT THE (Q1) TRANSISTOR IN HOLES 10, 11 AND 12. MAKE SURE THE BASE (B) GOES IN HOLE 13, THE COLLECTOR (C) IN HOLE 12, AND THE EMITTER (E) IN HOLE 10. SOLDER USING HEAT SINK.
7. MOUNT THE (Q2) TRANSISTOR IN HOLES 13, 14, 15. MAKE SURE THE BASE (B) GOES IN HOLE 13, THE COLLECTOR (C) IN HOLE 14, AND THE EMITTER (E) IN HOLE 15. SOLDER USING HEAT SINK.
8. CUT 4 PIECES OF WIRE 4" LONG. STRIP 1/4" OFF ENDS. SOLDER 2 WIRES TO HOLES 16 AND 17.
9. SOLDER WIRES TO HOLES 16 & 17 AND TO TERMINALS OF SWITCH.
10. SOLDER WIRES TO HOLES 18 & 19 AND TO TERMINALS OF SPEAKER.
11. SOLDER RED LEAD OF BATTERY CLIP TO POSITIVE (+) MARKED HOLE, BLACK LEAD TO NEGATIVE (-) MARKED HOLE.

REFERENCES:


Emitter (e)
Bottom view of Transistor
Base (b)
Collector (c)

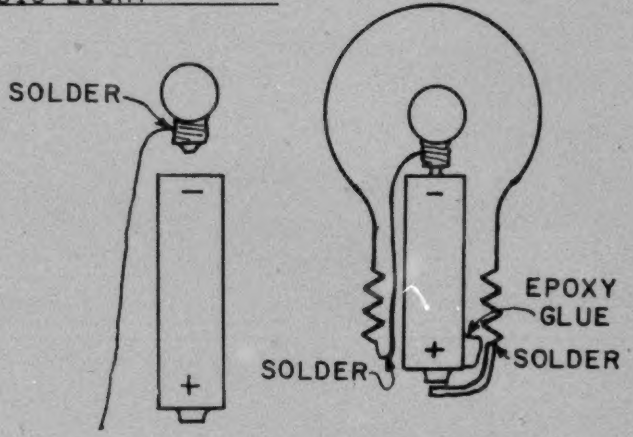
SIREN (CON'T)

12. CONNECT BATTERY TO CLIP AND TEST.
13. ON ANOTHER PLAN SHEET, DESIGN A HOLDER FOR SIREN.

TITLE: MAGIC LIGHT

COST: ____________

SKETCH:



MATERIAL:

1 BURNED OUT BULB (60, 75 OR 100 WATT SIZE)

1 PC. SHIM BRASS 3/16" X 15/16", .003 THICK

1 FLASHLIGHT CELL

PENCIL

1 FLASHLIGHT BULB, 1.5 VOLTS

TOOLS & EQUIPMENT: SOLDERING GUN, SOLDER, KNIFE, SCREWDRIVER, HAND DRILL, 1/16" TWIST DRILL BIT, EPOXY GLUE

PROCEDURES:

REFERENCES:

1. SOLDER A PIECE OF MAGNET WIRE TO THE BASE OF THE FLASHLIGHT BULB AS IN DRAWING.
2. REMOVE THE CENTER TERMINAL OF THE LAMP BULB AND CEMENT SURROUNDING IT WITH A KNIFE BLADE.
3. BREAK OFF THE GLASS STEM WHICH EXTENDS INTO THE NECK OF THE LAMP BULB WITH THE BLADE OF THE SCREWDRIVER. (SEE INSTRUCTOR)
4. DRILL A 1/16" HOLE THROUGH THE FLAT PART OF THE LAMP BASE FOR THE LEAD FROM THE FLASHLIGHT.
5. SOLDER THE CENTER TERMINAL OF THE FLASHLIGHT BULB TO THE BOTTOM (NEGATIVE SIDE) OF THE BATTERY. (CLAMP THE BATTERY FIRMLY IN A VISE BETWEEN TWO PIECES OF WOOD WITH THE CLEANED END UPWARD.) PLACE A DROP OF SOLDER ON THIS END AND WHILE THE SOLDER IS STILL LIQUID, QUICKLY PRESS THE TERMINAL OF THE FLASHLIGHT BULB INTO THE MOLTEN SOLDER, HOLDING IN PLACE UNTIL THE SOLDER HARDENS.
6. TEST CONNECTION BY TOUCHING LOOSE WIRE TO POSITIVE TERMINAL. LIGHT SHOULD LIGHT.
7. LOOP WIRE THROUGH HOLE IN LAMP BASE FROM UNDERSIDE, THEN INSERT CELL AND BULB ASSEMBLY IN THE BASE OPENING UNTIL IT PROTRUDES ABOUT 1/16".
8. SECURE THE END OF THE CELL TO THE METAL BASE WITH EPOXY GLUE.
9. REMOVE INSULATION FROM END OF WIRE AND SOLDER TO BASE.
10. BEND STRIP OF METAL SO THAT IT WILL BE ABOUT 1/32" FROM POSITIVE TERMINAL OF PENLIGHT CELL. SOLDER TO BASE.

TITLE: CODE OSCILLATOR

COST:

MATERIAL:

GRAYMARK KIT #503 FOR CODE OSCILLATOR

SKETCH:

TOOLS & EQUIPMENT: PENCIL SOLDERING IRON, NEEDLE NOSE PLIERS, SIDE CUTTER, SOLDER, HEAT SINK, SCREW DRIVER

PROCEDURES:	REFERENCES:
1. OPEN YOUR KIT AND CHECK FOR COMPLETENESS AGAINST PARTS LIST. 2. FAMILIARIZE YOURSELF WITH THE OSCILLATOR'S CIRCUIT ON PAGE 2 AND IDENTITY OF THE COMPONENTS USED IN THE PROJECT. 3. PREPARE YOUR "BREAD BOARD" CIRCUIT IN ACCORDANCE WITH INSTRUCTIONS ON PAGES 5 AND 15. 4. PERFORM EXPERIMENTS IN STEPS D, E, F, G & H. 5. PREPARE YOUR FINAL P. C. BOARD AND MOUNT IN CABINET AS DESCRIBED IN STEP 1.	

APPENDIX C

STUDENT MANAGEMENT SYSTEM FORMS

INCLUDED IN THIS APPENDIX TO THE GUIDE IS A COMPLETE SET OF FORMS USED IN THE STUDENT MANAGEMENT SYSTEM. THEY APPEAR IN THE SAME ORDER RECOMMENDED FOR STUDENT USE. TO DETERMINE THE NUMBER OF FORMS TO PRINT AND THE PAPER COLOR CODING, REFER TO WORKSHEET SERIES 11. XEROX OR TYPE THE FORMS AS THEY APPEAR IN THIS SECTION OR REVISE FOR YOUR NEEDS.

ATTENDANCE AND TIME UTILIZATION

NAME ____________________ PERIOD ________ GRADE _____ NOTEBOOK # ________

EXAMPLE ____________________

PRESENT	■	MADE PLANS FOR MAKING OWL
ABSENT		
SCHOOL VACATION	V	CHRISTMAS VACATION
	■	CUT OWL OUT ON BAND SAW
SCHOOL ACTIVITY	A	AWARDS ASSEMBLY

JANUARY

27		
28		
29		
30		

FEBRUARY

3		
4		
5		
6		
7		

10		
11		
12		
13		
14		

17		
18		
19		
20		
21		

FEBRUARY

24

25

26

27

28

MARCH

3

4

5

6

7

17

18

19

20

21

24

25

26

27

28

31

APRIL 1

2

3

4

STUDENT PERFORMANCE RECORD

NAME ________________________________ NOTEBOOK # _

SCHOOL ______________________ GRADE __________ PERIOD ______

FILL IN THE CIRCLE AFTER YOU COMPLETE THE OPERATION

EXAMPLE: ○ STEP BY STEP PROCEDURE

PLANNING

- ○
- ○ ARCHITECTURAL DRAWING
- ○ BILL OF MATERIAL
- ○ DIMENSIONING
- ○ DRAWING INSTRUMENTS
- ○ ISOMETRIC DRAWING
- ○ JIG DESIGNING & BUILDING
- ○ LAYOUT DRAWING
- ○ OBLIQUE DRAWING
- ○ ORTHOGRAPHIC (2 VIEW)
- ○ PERSPECTIVE DRAWING
- ○ SKETCHING
- ○ STEP BY STEP PROCEDURE
- ○ TEMPLATE MAKING

STATIONARY EQUIPMENT

- ○
- ○
- ○ ARC WELDER
- ○ BAND SAW
- ○ BELT - DISC SANDER
- ○ BENDER
- ○ BEVERLY SHEAR
- ○ BRAKE (BOX & PAN)
- ○ BUFFER
- ○ DRILL PRESS
- ○ FORGE
- ○ FOUNDRY FURNACE
- ○ GRINDER
- ○ HORIZONTAL BANDSAW
- ○ INJECTION MOLDER
- ○ JOINTER
- ○ METAL LATHE
- ○ MITER BOX SAW
- ○ OXYACETYLENE WELDER
- ○ OVEN
- ○ PANTOGRAPH
- ○ PLATEN PRESS
- ○ RADIAL ARM SAW
- ○ ROTATIONAL MOLDER
- ○ SANDER - GRINDER
- ○ SCROLL SAW
- ○ SIGN PRESS
- ○ SLIP ROLL FORMER
- ○ SOLDERING FURNACE
- ○ SQUARING SHEAR
- ○ STRIP HEATER
- ○ TABLE SAW
- ○ UNIPLANE
- ○ VACUUM FORMER
- ○ WIRE WHEEL
- ○ WOOD LATHE

PORTABLE POWER TOOLS

- ○
- ○ BELT SANDER
- ○ ELECTRIC DRILL
- ○ HEAT GUN
- ○ MOTO-TOOL
- ○ PROPANE TORCH
- ○ ROUTER
- ○ SABER SAW
- ○ SPOT WELDER
- ○ VIBRATOR SANDER
- ○ VIBRO TOOL ENGRAVER

HAND TOOL OPERATIONS

- ○
- ○ BORING
- ○ CHISEL
- ○ MEASURING
- ○ PLANING
- ○ SANDING
- ○ SAWING
- ○ SQUARING
- ○ SURFORM SHAPING
- ○ WOOD FILING

FASTENERS

- ○
- ○ CORRUGATED FASTENERS
- ○ BELT SNAPS
- ○ BOLTS
- ○ NAILS
- ○ POP RIVETS
- ○ RAPID RIVETS
- ○ TINNERS RIVETS
- ○ SOFT STEEL RIVETS
- ○ SHEET METAL SCREWS
- ○ WOOD SCREWS

GLUES GLUING PROCESS AND JOINTS

- ○
- ○ CLEAR HOUSEHOLD CEMENT
- ○ CONTACT CEMENT
- ○ EPOXY GLUE
- ○ PVA - WHITE GLUE
- ○ RUBBER CEMENT
- ○ UREA - WATER RESISTANT GLUE
- ○ EDGE GLUING
- ○ FACE GLUING
- ○ LAMINATING VENEER
- ○ BUTT JOINT
- ○ DADO JOINT
- ○ DOWEL JOING
- ○ LAP JOINT
- ○ MITER JOINT
- ○ RABBET JOINT

FINISHING

- ○
- ○ BRUSHING
- ○ BURNING
- ○ FRENCH POLISH
- ○ OIL FINISH
- ○ POLISHING
- ○ SEALING
- ○ SPRAYING
- ○ SPECIAL EFFECTS
- ○ STAINING
- ○ WOOD FILLER

POWER MECHANICS

- ○
- ○ ASSEMBLE 2 STROKE
- ○ ASSEMBLE 4 STROKE
- ○ CHECK COMPRESSION
- ○ CLEAN & ADJUST BRAKER POINTS
- ○ CLEAN AND GAP PLUG
- ○ DISASSEMBLE 2 STROKE
- ○ DRAIN & REFILL CRANKCASE
- ○ LAP VALVES
- ○ REPLACE RINGS
- ○ TUNE UP SMALL ENGINE

POWER MECHANICS TOOLS

- ○
- ○ COMPRESSION GAUGE
- ○ FEELER GAUGE
- ○ MICROMETER
- ○ RIDGE REAMER
- ○ RING COMPRESSOR
- ○ TORQUE WRENCH
- ○ VALVE SPRING COMPRESSOR
- ○ WHEEL PULLER

SHEET METAL

- ○
- ○ BENDING
- ○ CHASING
- ○ CUTTING
- ○ DRILLING HOLES
- ○ ETCHING
- ○ FILING
- ○ FORMING
- ○ HEMING
- ○ PATTERN LAYOUT
- ○ PEENING
- ○ PUNCHING HOLES
- ○ ROLLING
- ○ SEAMING
- ○ SOLDERING
- ○ SPINNING

BENCH METALS

- ○
- ○ COLD BENDING
- ○ CUTTING
- ○ DRILLING W/CUTTING OIL
- ○ FILING
- ○ POLISHING
- ○ TAP & DIE THREADING
- ○ TWISTING

FORGING

- ○
- ○ ANNEALING
- ○ BENDING
- ○ EYE OR RING FORGING
- ○ FLARING
- ○ HARDENING
- ○ SQUARE TO ROUND
- ○ TAPER FORGING
- ○ TEMPERING
- ○ TWISTING

FOUNDRY EXPERIENCES

- ○
- ○ MATCH PLATE
- ○ POURING ASSISTANT
- ○ PATTERN MAKING
- ○ RAMMING
- ○ SINGLE PATTERN CASTING
- ○ SPLIT PATTERN CASTING
- ○ STYROFOAM CASTING

WELDING

- ○
- ○ ARC
- ○ BRAZING
- ○ CUTTING
- ○ GAS-FUSION & ROD
- ○ SILVER SOLDERING
- ○ SPOT WELDING

PLASTICS

- ○
- ○ ACRYLIC LAMINATING
- ○ ACRYLIC THERMOFORMING
- ○ CASTING RESIN
- ○ EXPANDABLE POLYSTYRENE
- ○ HIGH PRESSURE LAMINATING
- ○ FIBERGLASS GELL COATING
- ○ FIBERGLASS LAMINATING
- ○ FIBERGLASS MOLD PREPARATION
- ○ FIBERGLASS PART REPAIR
- ○ INJECTION MOLDING
- ○ PLASTISOL DIP MOLDING
- ○ ROTATIONAL MOLDING
- ○ VACUUM FORMING
- ○ ULTRACAL CASTING

GRAPHICS

- ○
- ○ CARVE & PRINT LINOLEUM BLOCK
- ○ CUT STENCIL
- ○ ENGRAVE & PRINT DRY POINT
- ○ MARBLING
- ○ OFFSET PRINTING
- ○ PANTOGRAPH ENGRAVING
- ○ STENCIL PRINT
- ○ SET TYPE FOR NAME STAMP
- ○ SIGN PRESS PRINTING
- ○ SILK SCREEN PRINTING
- ○ THERMOGRAPHY
- ○ VIBRO TOOL ENGRAVING

ELECTRICITY

- ○
- ○ BUILD A RUNNING MOTOR
- ○ COIL CONSTRUCTION
- ○ HOUSE WIRING
- ○ KIT CONSTRUCTION
- ○ LAB VOLT EXPERIENCES
- ○ MCKNIGHT EXPERIMENTER
- ○ PARALLEL WIRING
- ○ PRINTED CIRCUIT
- ○ RADIO CIRCUITRY
- ○ SERIES WIRING
- ○ SOLDERED CONNECTIONS
- ○ VOLT OHM METER

CRAFTS

- ○
- ○ ART METAL
- ○ CARVING LEATHER
- ○ COPPER ENAMEL
- ○ CUTTING LEATHER
- ○ DYING
- ○ LACING
- ○ STAMPING
- ○ TOOLING FOIL
- ○ TOOLING LEATHER
- ○ WOOD CARVING

GENERAL INDUSTRY

- ○
- ○ CASTING
- ○ DRYWALL
- ○ FULL SCALE CORNER CONSTRUCTION
- ○ 1/2 SCALE CORNER CONSTRUCTION
- ○ LAY BRICK & STONE
- ○ MASS PRODUCTION
- ○ MIX CONCRETE
- ○ MIX MORTAR
- ○ MODEL ASSEMBLY
- ○ PLUMBING
- ○ ROOFING
- ○ SHED CONSTRUCTION
- ○ TILE

			NONE OF THE TIME			HALF OF THE TIME			ALL OF THE TIME
		MONTH	1	2	3	4	5	6	7
1.	I ONLY OPERATE A MACHINE WHEN I'M POSITIVE I KNOW HOW.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
2.	I USE THE PLANNING SHEET IN THINKING THROUGH MY ACTIVITIES.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
3.	I USE THE MEDIA PROVIDED IN THE SHOP.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
4.	I COMPLETE PROJECTS THAT I START.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
5.	MATERIALS COST MONEY, SO I AM CAREFUL IN SELECTING PIECES THAT WILL ELIMINATE WASTE.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
6.	MY TIME IS VALUABLE, SO I USE EVERY MINUTE.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
7.	I AM PROUD OF MY ACCOMPLISHMENTS IN THE SHOP.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
8.	I KNOW THE SAFETY RULES OF ANY MACHINES BEFORE TURNING THEM ON.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
9.	I CLEAN UP AND LEAVE MY WORK AREA IN GOOD SHAPE FOR THE NEXT PERSON.	____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0
		____	0	0	0	0	0	0	0

EQUIPMENT OPERATION CHECK LIST

NAME ____________________ PERIOD NO ______ GRADE LEVEL ______ NOTEBOOK NO. ______

1. YOU ARE RESPONSIBLE TO PREPARE YOURSELF BY USING THE MEDIA, BOOKS, FILMS, CHARTS, ETC.
2. CHECK (✓) APPROPRIATE COLUMNS BELOW.
3. ASK INSTRUCTOR TO CHECK YOU OUT ON THAT EQUIPMENT.
4. YOU ARE RESPONSIBLE TO HAVE INSTRUCTOR INITIAL THAT YOU HAVE DEMONSTRATED PROPER AND SAFE OPERATION.

SHOP PERMIT ____________________

*MEDIA USED TO FIND INFORMATION

EQUIPMENT OPERATION NOTEBOOK	BOOKS & CHARTS	FILMS	TAPES	TAUGHT BY OTHERS	*STATIONARY EQUIPMENT	TEACHER INITIALS	DATE
					BAND SAW		
					BELT & DISC SANDER		
					BENCH FURNACE		
					BEVERLY SHEAR		
					BRAKE (BOX & PAN)		
					BUFFER		
					DRILL PRESS		
					HORIZONTAL BAND SAW		
					INJECTION MOLDER		
					METAL BENDER		
					OVEN		
					ROTATIONAL MOLDER		
					SANDER GRINDER		
					SCROLL SAW		
					SIGN PRESS		
					SLIP ROLL FORMER		
					SQUARING SHEAR		
					STRIP HEATER		
					VACUUM FORMER		
					WIRE WHEEL		
					WOOD LATHE		
					*PORTABLE TOOLS		
					BELT SANDER		
					ELECTRIC DRILL		
					HEAT GUN		
					MOTO-TOOL		
					PROPANE TORCH		
					ROUTER		
					SABER SAW		
					SPOT WELDER		
					VIBRATOR SANDER		
					VIBRO TOOL ENGRAVER		
* YOU MUST HAVE INSTRUCTOR PERMISSION EACH TIME YOU USE THE FOLLOWING MACHINES.							
					ARC WELDER		
					FORGE FURNACE		
					FOUNDRY FURNACE		
					GRINDER		
					JOINTER		
					METAL LATHE		
					OXY-ACETYLENE WELDER		
					PANTOGRAPH		
					RADIAL ARM SAW		
					TABLE SAW		
					UNIPLANE		

PLAN SHEET

STUDENT NAME ______ PERIOD ______ GRADE ______ NOTEBOOK # ______

PROJECT NAME ______ STARTING APPROVAL ______ FINISHING APPROVAL ______

SKETCH

TOOLS & EQUIPMENT ______

STEP BY STEP PROCEDURES:

REFERENCES: MEDIA

STEP BY STEP PROCEDURES:

REFERENCES: MEDIA

BILL OF MATERIAL:

		AMOUNT OF MATERIAL							
NO. OF PARTS	NAME OF PART(S)	DIA.	TH.	W.	L.	QUANTITY	UNIT OF MEASURE	TYPE OF MATERIAL	ITEM COST

TOTAL COST ____

NOTE: IF YOU MAKE A MISTAKE AND RUIN A PART, YOU MUST PAY FOR ANY NEW MATERIAL YOU GET.

NOTE: ENTER TOTAL COST ON YOUR MATERIALS COST RECORD BEFORE YOU HAVE YOUR PLAN SHEET APPROVED.

MATERIAL COST RECORD

NAME ______________________ PERIOD ___ GRADE LEVEL ___ NOTEBOOK # _____

DATE	MATERIAL OR PROJECT	DEBIT (MONEY SPENT)	CREDIT (MONEY PAID)	BALANCE (MONEY LEFT)
EXAMPLE:				
9-25-75	MATERIAL PAYMENT		1.50	1.50
9-26-75	CARVING PROJECT	.60		.90
9-27-75	ABRASIVE CLOTH	.05		.85

NAME ______________________ PERIOD ____ GRADE LEVEL ____ NOTEBOOK # __________

DATE	MATERIAL OR PROJECT	DEBIT (MONEY SPENT)	CREDIT (MONEY PAID)	BALANCE (MONEY LEFT)

	METAL	PLASTIC	CRAFT	GRAPH	POWER	ELECT.	GUID.	WELD	DRAW	WOOD
BASIC 10 PROJECT										
OWN PROJECT										

PROJECT EVALUATION

NOTEBOOK # ______________________

DATE ______________________

PERIOD ______________________

NAME: ____
LAST FIRST MIDDLE INITIAL

GRADE: 7 8 9

SEX: MALE FEMALE

PREVIOUS SHOP EXPERIENCE: 0 YEARS 1 YEAR 2 YEARS

LISTED BELOW ARE SIX QUESTIONS WHICH ARE CONCERNED WITH YOUR SATISFACTION IN MAKING A PROJECT. THERE ARE NO RIGHT OR WRONG ANSWERS FOR ANY QUESTIONS. YOU SHOULD SELECT THE ANSWER WHICH SHOWS WHAT YOU FEEL ABOUT THE QUESTION. ANSWER EACH QUESTION BY MAKING A CIRCLE AROUND THE NUMBER TO THE RIGHT WHICH REFLECTS HOW YOU FEEL ABOUT THAT QUESTION. BELOW ARE TWO SAMPLE QUESTIONS:

SAMPLE QUESTIONS: HOW DO YOU FEEL ABOUT:	VERY UNSATISFIED						VERY SATISFIED
A. THE WAY YOU PLAY FOOTBALL?	1	2	3	4	5	6	[✓ 7]
B. THE WAY YOU SING?	1	2	3	[✓ 4]	5	6	7

* * * * * * * * * * * * *

HOW DO YOU FEEL ABOUT:							
1. THE WAY YOU PLANNED YOUR PROJECT?	1	2	3	4	5	6	7
2. YOUR CHOICE OF MATERIALS IN MAKING YOUR PROJECT?	1	2	3	4	5	6	7
3. THE WAY YOU USED TOOLS AND EQUIPMENT WHEN YOU WERE MAKING YOUR PROJECT?	1	2	3	4	5	6	7
4. HOW HARD YOU WORKED IN MAKING YOUR PROJECT?	1	2	3	4	5	6	7
5. THE QUALITY OF YOUR PROJECT NOW THAT YOU HAVE FINISHED IT?	1	2	3	4	5	6	7
HOW DO YOU THINK:							
6. YOUR TEACHERS FEEL ABOUT THE QUALITY OF YOUR PROJECT?	1	2	3	4	5	6	7

ON QUESTIONS 7 THROUGH 12, WRITE YOUR ANSWER ON THE LINES PROVIDED.

7. WHAT PROJECT DID YOU JUST COMPLETE? ________________________________

____

8. WHICH AREA OF THE SHOP WAS THIS PROJECT FROM? ______________________

____

9. HAVE YOU MADE OTHER PROJECTS IN THIS AREA OF THE SHOP? ______________

____

10. WHAT DO YOU FEEL YOU DID WELL ON THIS PROJECT? ______________________

____

11. WHAT DO YOU FEEL YOU DID NOT DO WELL ON THIS PROJECT? ______________

____

12. WHAT WOULD YOU DO DIFFERENTLY IF YOU WERE TO DO THIS SAME PROJECT AGAIN? ____

____

____

____

PUT A (✓) IN THE BLANK BY YOUR ANSWER ON QUESTIONS 13 AND 14.

13. DID YOU USE A "BASIC 10" OR DID YOU DRAW UP YOUR OWN PLAN?

______________ BASIC 10 PLAN ____________________ OWN PLAN

14. ARE YOU INTERESTED IN STARTING ON ANOTHER PROJECT VERY SOON?

______ YES ______ UNDECIDED ______ NO

CALAPOOYA JUNIOR HIGH SCHOOL

ALBANY UNION HIGH SCHOOL DISTRICT 8J

DEAR PARENT:

AS PART OF THE PROGRAM IN OUR SHOP AT CALAPOOYA, YOUR CHILD WILL HAVE THE OPPORTUNITY TO OPERATE VARIOUS TYPES OF POWER MACHINERY. WE WISH TO EMPHASIZE THAT BEFORE A CHILD IS ALLOWED TO OPERATE POWER TOOLS, HE WILL PREPARE HIMSELF THROUGH THE USE OF SINGLE CONCEPT FILMS, BOOKS, CHARTS AND OPERATING PROCEDURE LISTS. HIS OPERATING PROCEDURES WILL BE CHECKED BY AN INSTRUCTOR AND HE WILL HAVE THE BEST POSSIBLE SUPERVISION WHILE OPERATING THE EQUIPMENT.

SAFETY IS STRESSED IN EACH OF THE AREAS IN THE INDUSTRIAL ARTS DEPARTMENT, AS WELL AS THROUGHOUT OUR SCHOOL. SEE THE GENERAL SAFETY RULES ON BACK. WE FEEL THAT WE DO HAVE A VERY GOOD RECORD IN KEEPING CHILDREN FROM BEING INJURED WHILE IN SHOP CLASS.

IN ORDER FOR US TO HAVE AN AWARENESS THAT YOU DO HAVE A KNOWLEDGE OF YOUR CHILD'S ACTIVITIES, WE MUST HAVE YOUR CONSENT BEFORE ALLOWING YOUR CHILD TO USE ANY POWER EQUIPMENT.

THE INDUSTRIAL ARTS STAFF AT CALAPOOYA WOULD LIKE TO INVITE YOU TO VISIT OUR SHOP FACILITIES. YOU ARE WELCOME TO VISIT THE SHOP AT ANY TIME; PLEASE CHECK THROUGH THE MAIN OFFICE. UNDER OUR FORMAT OF MORE INDIVIDUALIZED INSTRUCTION, IT WILL BE MORE CONVENIENT TO HAVE VISITORS THAN IT HAS BEEN IN THE PAST YEARS.

YOURS TRULY,

THE INDUSTRIAL ARTS DEPARTMENT
CALAPOOYA JUNIOR HIGH SCHOOL

- -

I GIVE MY PERMISSION FOR ____________________ TO USE POWER
(STUDENT'S NAME)
EQUIPMENT IN THE INDUSTRIAL ARTS SHOPS AT CALAPOOYA JUNIOR HIGH.

____________________ ____________________
DATE PARENT'S SIGNATURE

SAFETY RULES

GENERAL

1. DO NOT ENTER THE SHOP UNLESS AN INSTRUCTOR IS PRESENT.
2. EYE PROTECTION IS REQUIRED WHEN USING ANY POWER TOOL OR AT ANY OTHER TIME YOU SUSPECT THERE MAY BE EYE DANGER.
3. LONG HAIR IS DANGEROUS. SPECIAL CARE MUST BE TAKEN TO PREVENT ACCIDENTS.
4. PROPER CLOTHING MUST BE WORN. NO LOOSE, RAGGED, OR SLOPPY CLOTHING. REMOVE LOOSE JEWELRY BEFORE OPERATING MACHINES.
5. ABSOLUTELY NO HORSEPLAY IN THE SHOP. OTHERS CAN BE INJURED BY YOUR ACTIONS.
6. DEVOTE ALL YOUR ATTENTION TO THE MACHINE OR TOOL YOU ARE USING.
7. SAFETY LINES ARE FOR YOUR PROTECTION. STAY BEHIND THEM UNLESS YOU ARE USING A MACHINE WITHIN THE SAFETY LINE AREA.
8. TOOLS AND MATERIALS CAN BE DANGEROUS. DO NOT HANDLE UNLESS YOU HAVE SOMETHING SPECIFIC IN MIND.
9. WHEN HELP IS NEEDED ON AN OPERATION, ASK FOR ONLY ENOUGH TO DO THE JOB.
10. CLEAN YOUR AREA WHEN THROUGH.
11. DISCONNECT POWER BEFORE CHANGING BLADES OR BELTS.
12. DO NOT LEAVE A MACHINE UNTIL ALL MOTION HAS STOPPED.

WELCOME!

As Industrial Arts students at this school, you will have a unique opportunity to plan, experiement, and build in a shop facility which has been organized in a manner which permits activities in many different areas. You will have the opportunity to work with Metals, Wood and Plastics, rebuild two and four cycle engines, construct Electronic gear, and design in the Graphics area of the facility.

To accomplish all these things, you will be using many various systems which will be of assistance. The color coded notebooks, basic ten sample projects, area orientation signs, color coded tool panels, and facility layout will aid in allowing more activities to be operating at one time.

We are very proud of our facility and hope you will also become part of that pride by helping your fellow students and teachers keep the shop safe by returning tools to panels, and by placing materials and resources back in their respective positions.

STUDENT NOTEBOOKS

You will be assigned your own personal notebook for use in the shop, which is color coded according to your period. For example, the first period color may be red, and has a number corresponding to your name. As you enter, pick up your notebook and take it to the Plug-in Box in the area in which you will be working.

Your notebook tells other students which area you will be working out of that day.

As you purchase your materials, develop projects and activities, your notebook will be within reach to assist you in planning and recording information.

COLOR CODE

The basic areas of the shop can be identified by the wood signs that hang from the ceiling and the color coded wall panels. The various self-contained areas are color coded, and the tools, materials, books, films and other various aids are marked with the board color in each area.

The following is the color code for each area of the shop:

Area	Color
Woods	Yellow
Cold Metals	Blue
Hot Metals	Red
Plastics	Pink
Crafts	Purple
Power Mechanics	Orange
Graphics & Drafting	Green
General Industries	Gray
Elect/Electronics	White
Planning (Media)	Wood Grain (Stain)

To help you identify Power Tools, Guards, and other hazards, the following color code is used:

POWER TOOLS

GREEN — The primary job of color code as applied to machinery and power tools is to separate the critical from the non-critical parts. This is done by painting the critical operating parts and focal work areas in a color that stands out in contrast with non-critical GREEN body of the machine.

GUARDS & SWITCHES

ORANGE Moving parts on machines can be a safety hazard. To minimize this hazard, any moving parts such as guards and switches are painted a bright ORANGE for instant recognition.

CONTROLS

YELLOW The controls of a machine are painted a bright YELLOW to command attention to making adjustment.

WATCH OUT

YELLOW Around each Power Tool and any part that special consideration should be given to your safety, you will find a wide YELLOW stripe marked on the floor. Stay out of this area unless you are the operator of a Power Tool, or you are asked to help the operator. All people in this area will wear goggles at all times.

FIRE PROTECTION

RED RED, the color associated with fire, is used to identify the location of fire fighting equipment.

STUDENT PERFORMANCE RECORD FORM

This form is for your use in recording your activities in the shop. As you do an activity, mark in front of the appropriate listing or if you do an activity that is not listed, record it in the appropriate area blank.

MATERIAL COST RECORD FORM

As your project requires materials and supplies that are owned by the shop, you will use this form to record your expenses. In the example, the first recording is the purchase of your material payment card. This is to be purchased in the school office. Fill out your notebook and material payment to an instructor. The instructor will initial the entry of your payment amount. Your receipt is the instructor's initials in the credit column of the form. Be sure your name is on the form in ink.

Before you start an activity, experiment or project, record the name and any costs in the debit column, subtract the cost from the balance and record the new balance in the balance column. When your balance is not sufficient to cover your next activity, another material payment should be made in the office.

ATTENDANCE & TIME UTILIZATION FORM

Mark this sheet for each day you are in class. Refer to the key at the top of the sheet to see the different things you should mark. Note the example shown and mark.

EQUIPMENT OPERATION CHECK

For your safety and the safety of others, we have an Equipment Operation check sheet. Once you start a project and you need some kind of Power Equipment, you must first become knowledgeable on the Safety Rules of the equipment and how to operate it. This information can be found in the Power Equipment Notebook. Film, Tape and Textbook References are listed in the Notebooks also.

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When you have completed your study, place a check in the media column you used to get your information on the Equipment Operations sheet. After you have been checked out, present this sheet to the teacher and he will initial your Equipment Operation Sheck Sheet, if you have been successful in answering questions about safety and if you have been successful in the operation of the Power Equipment.

THE TEACHER WILL NOT INITIAL THE CHECK SHEET IF YOU NEED MORE PREPARATION.

TEACHER INITIALS WILL BE REMOVED FROM THE CHECK LIST WHEN YOU DEMONSTRATE AT ANY TIME THAT YOU ARE CARELESS AND UNSAFE WITH ANY OF THE EQUIPMENT LISTED.

THE PLAN SHEET

EACH ACTIVITY OR PROJECT, NO MATTER HOW LARGE OR SMALL, MUST HAVE A COMPLETED PLAN SHEET MADE OUT TO GO WITH IT AND INITIALED BY AN INSTRUCTOR.

REGULAR PLAN SHEETS SHALL INCLUDE:

1. DRAWING OR SKETCH OF AN OBJECT.
2. DIMENSIONS OF THE PARTS.
3. MATERIALS NEEDED.
4. COST OF ALL MATERIALS.
5. TOOLS TO BE USED IN MAKING IT.
6. STEP BY STEP PROCEDURE, TELLING HOW YOU INTEND TO MAKE IT.

PROPER USE OF THE PLAN SHEET ELIMINATES MANY MISTAKES AND WASTE OF MATERIALS.

PLAN SHEETS MUST BE GONE OVER BY AN INSTRUCTOR AND INITIALED, BEFORE STARTING YOUR PROJECT.

USE OF FILMS, BOOKS AND RESOURCES

LOCATED THROUGHOUT THE SHOP, YOU WILL FIND MANY PIECES OF EQUIPMENT AND RESOURCE MATERIALS TO USE IN LEARNING ABOUT THE TOOLS AND MACHINES IN THE SHOP, AND FOR HELPING YOU SOLVE THE PROBLEMS YOU MAY ENCOUNTER AS YOU WORK ON YOUR PROJECT.

THIS EQUIPMENT IS AVAILABLE IN THE SHOP SO THAT YOU WILL BE ABLE TO PROCEED WITH YOUR WORK IN THE MOST EFFICIENT MANNER. THE MATERIALS ARE DISTRIBUTED ABOUT THE SHOP ACCORDING TO THE OPERATIONS THAT ARE CONDUCTED IN THE AREA.

MATERIALS THAT ARE AVAILABLE INCLUDE VARIOUS TYPES OF SINGLE CONCEPT FILM PROJECTORS, SUCH AS KODAK, TECHNICOLOR, AND A.B. DICK MACHINES. MAKE SURE YOU ARE FAMILIAR WITH THE OPERATING PROCEDURES OF ALL OF THEM AND FOLLOW THESE INSTRUCTIONS CAREFULLY TO INSURE THAT THE MACHINES AND FILMS WILL ALWAYS BE IN USABLE OPERATING CONDITION, FOR FELLOW STUDENTS.

THE FILMS FOR THE TECHNICOLOR AND A.B. DICK PROJECTORS ARE IN A SEALED PLASTIC MAGAZINE AND ARE THE CONTINUOUS LOOP TYPE. CARE SHOULD BE TAKEN WHEN PLACING THEM IN THE PROJECTOR TO INSURE THEY ARE INSERTED COMPLETELY. CARE ALSO SHOULD BE TAKEN TO KEEP THE FINGERS FROM TOUCHING THE FILM WHEN HANDLING THE MAGAZINES AND TO KEEP THE MAGAZINES IN THE STORAGE PROVIDED WHEN NOT IN USE TO PROTECT THE FILM FROM DUST AND DIRT. THE MAGAZINES ARE ALL MARKED WITH A NUMBER. WHEN A FILM LOOP IS REFERRED TO IN THE WRITTEN PROJECT INSTRUCTIONS, IT IS REFERRED TO BY PRODUCER AND NUMBER.

THE FILM MAGAZINES FOR THE KODAK PROJECTOR ARE NOT OF THE CONTINUOUS LOOP TYPE AND MUST BE REWOUND BEFORE REMOVAL FROM THE MACHINE. NORMALLY THIS IS ACCOMPLISHED AUTOMATICALLY WHEN THE END OF THE FILM IS REACHED. IF YOU WATCH ONLY A PORTION OF THE FILM, PRESS THE REVERSE END OF THE REVIEW BAR TO CAUSE THE FILM TO REWIND.

INFORMATION FOR YOUR USE IS ALSO AVAILABLE ON CASSETTE TAPES FOR USE ON THE TAPE PLAYERS. WHEN USING THE CASETTES, CARE MUST BE TAKEN TO KEEP THEM FREE OF DUST. CASSETTES MUST ALWAYS BE RETURNED TO PROPER STORAGE AREA WHEN NOT IN USE.

REFERENCE BOOKS ARE ALSO AVAILABLE IN EACH MEDIA AREA FOR YOUR USE. THEY ARE THE MOST MODERN AND UP-TO-DATE AVAILABLE. YOUR COOPERATION IN KEEPING THEM IN A CLEAN, USABLE CONDITION, WILL INSURE THAT THEY WILL BE AVAILABLE WHEN IT IS NECESSARY FOR YOU TO USE THEM.

CLEANUP

STUDENTS ARE EXPECTED TO ACCEPT RESPONSIBILITY.

A. AFTER USING ANY TOOL OR PIECE OF EQUIPMENT, IT SHOULD BE READY FOR ANOTHER PERSON'S USE.
B. LEAVE THE WORK AREA A LITTLE CLEANER AND NEATER THAN YOU FOUND IT.
C. APPROXIMATELY FIVE MINUTES BEFORE THE END OF CLASS - GENERAL CLEAN-UP OF AREA - AREAS YOU HAVE WORKED IN DURING THAT PERIOD.
D. IF USING FINISH ROOM, BE AWARE OF THE TIME FACTOR.
    1. DON'T TRY TO START APPLYING FINISH DURING LAST 15 MINUTES OF A PERIOD.
    2. CLEAN BRUSHES PROPERLY. PROCEDURE:
        A. CLEAN BURSH BY WIPING ON PAPER TOWELS.
        B. RINSE BRUSH IN PROPER SOLVENT:
            LACQUER - IN LAQUER THINNER
            SHELLAC - IN ALCOHOL
            LATEX PAINT - IN WATER
            OIL BASE - IN PAINT THINNER OR TURPENTINE (DRIES OVERNIGHT)
            PLASTIC RESINS - IN ACETONE
        C. WASH BRUSH WITH SOAP AND WATER. THIS WILL TAKE SEVERAL REPETITIONS. RINSE THOROUGHLY BETWEEN EACH STEP.
        D. WHEN A GOOD SUDS IS DEVELOPED, YOUR BRUSH IS CLEAN.
        E. RINSE AGAIN AND SHAKE OUT MOST MOISTURE.
        F. TURN THE BRUSH IN TO ONE OF YOUR INSTRUCTORS.
E. BE SURE THAT YOUR PROJECTS OR SUPPLIES ARE STORED IN THE PROPER PLACE BEFORE YOU LEAVE FOR YOUR NEXT CLASS.

HOW DO I GET STARTED

THE FIRST THING I WANT TO DO WHEN I WALK INTO A SHOP WHERE THERE ARE MATERIALS, TOOLS AND EQUIPMENT IS TO BUILD SOMETHING. WE HOPE YOU HAVE THE SAME DESIRE.

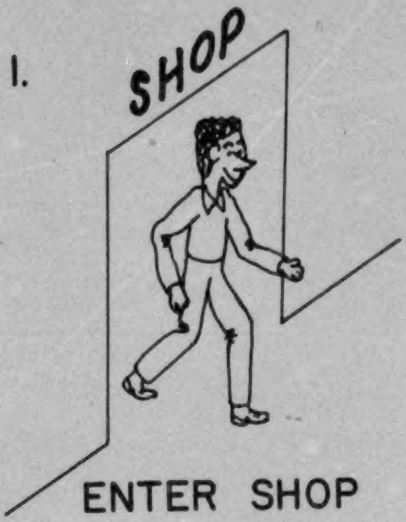
TO HELP YOU GET STARTED, WE HAVE ORGANIZED THE SHOP INTO AREAS OF INTEREST: METALS, PLASTICS, FOUNDRY, GRAPHICS, CRAFTS, WOOD, GENERAL INDUSTRIES, ELECTRICITY AND ELECTRONICS.

EACH AREA HAS SOME SAMPLE PROJECTS WHICH HAVE BEEN MADE FOR YOU TO LOOK AT FOR IDEAS. THESE PROJECTS EACH HAVE PLANS TO SHOW YOU FROM WHAT THEY ARE MADE AND HOW TO MAKE THEM. PLEASE TAKE SPECIAL CARE WHEN LOOKING AT THESE PROJECTS AND KEEP THEM IN THEIR PLACE.

THIS SHOP HAS BEEN DESIGNED FOR WORK, WITH INSTRUCTION AVAILABLE FROM MANY SOURCES, SO THAT YOU ARE NOT HELD UP FOR NEED OF AN ANSWER. SOME OF THE MANY RESOURCES INCLUDE FILMS, TAPES, BOOKS, CHARTS, SAMPLE PROJECTS AND FELLOW STUDENTS.

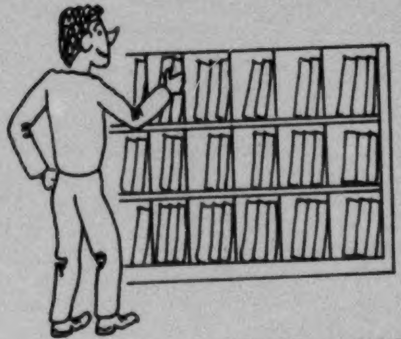
LET'S WALK THROUGH IT

1.



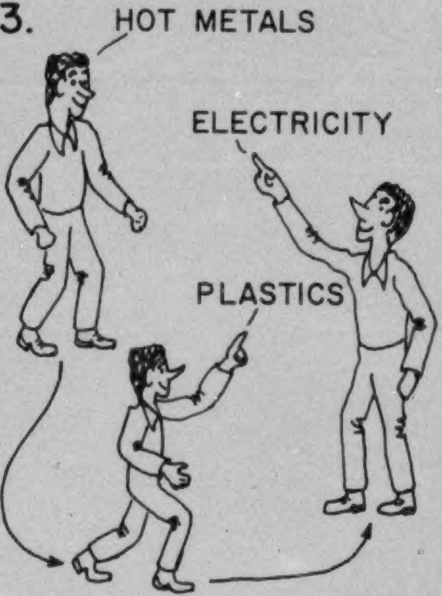
ENTER SHOP

2.



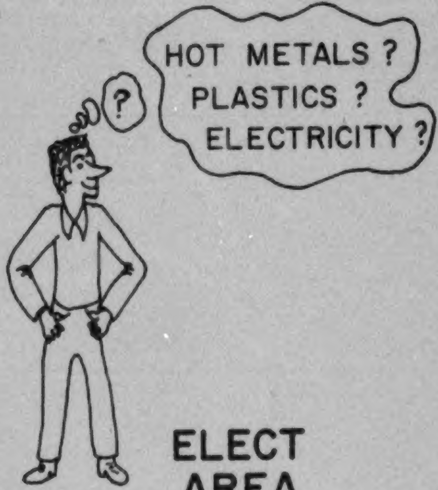
PICK UP NOTEBOOK

3.


HOT METALS
ELECTRICITY
PLASTICS

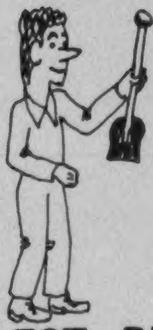
EXPLORE SHOP

4.


?
HOT METALS ?
PLASTICS ?
ELECTRICITY ?

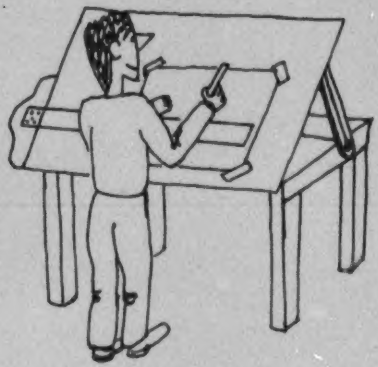
ELECT
AREA
YOU WOULD LIKE
TO WORK IN

5.



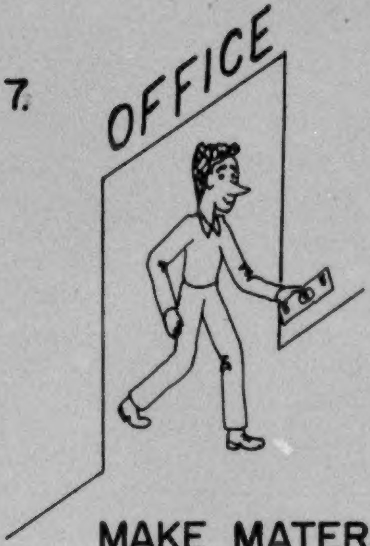
SELECT PROJECT
(YOUR IDEA)
(FROM SAMPLES)

6.



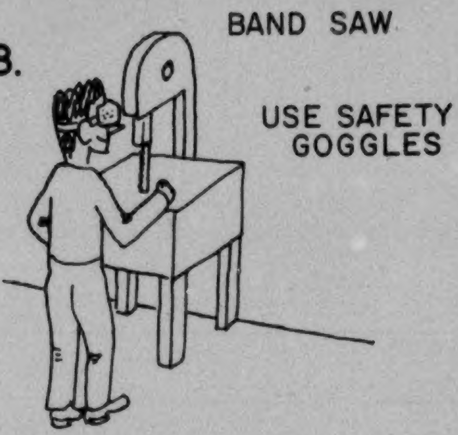
MAKE A PLAN AND
CONSULT WITH
TEACHER

7.



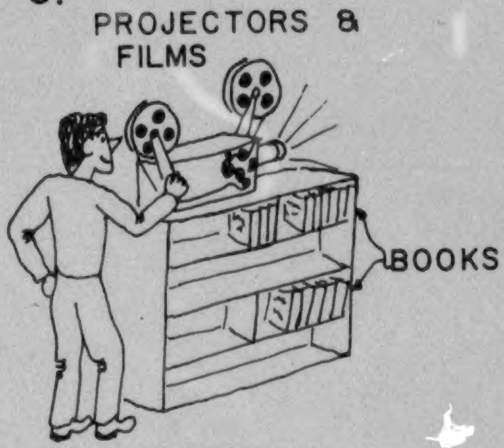
MAKE MATERIAL PAYMENT

8.


BAND SAW
USE SAFETY GOGGLES

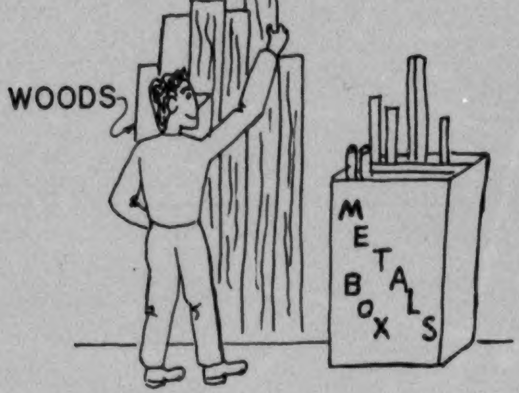
STUDY EQUIPMENT
LEARN SAFETY
RULES

9.


PROJECTORS &
FILMS
BOOKS

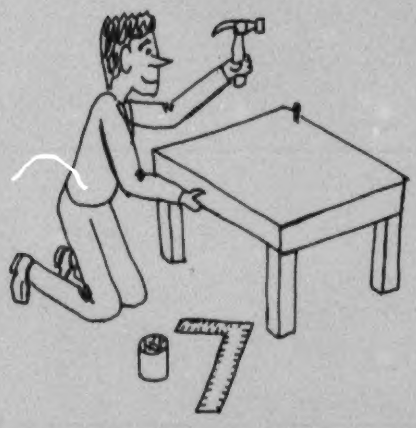
USE REFERENCES

10.


WOODS
METALS
BOX

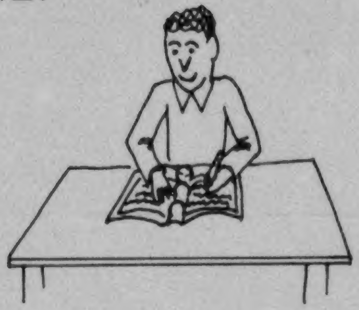
SELECT MATERIALS

11.



BUILD

12.



RECORD & EVALUATES
PERFORMANCE IN
NOTEBOOK

APPENDIX D

PRINTED SELF-INSTRUCTION MEDIA

THIS APPENDIX SECTION CONTAINS A COMPLETE SET OF EQUIPMENT OPERATION SHEETS AND ONE SAMPLE EACH OF AN INSTRUCTION AND INFORMATION SHEET. USE WORKSHEET 12.9 TO DETERMINE THE PAPER COLOR AND THE NUMBER OF SHEETS REQUIRED. USE THE SHEETS AS THEY APPEAR IN THIS SECTION TO BEGIN YOUR PROGRAM AND REVISE THE SHEETS TO MEET YOUR NEEDS DURING THE FIRST YEAR OF OPERATION.

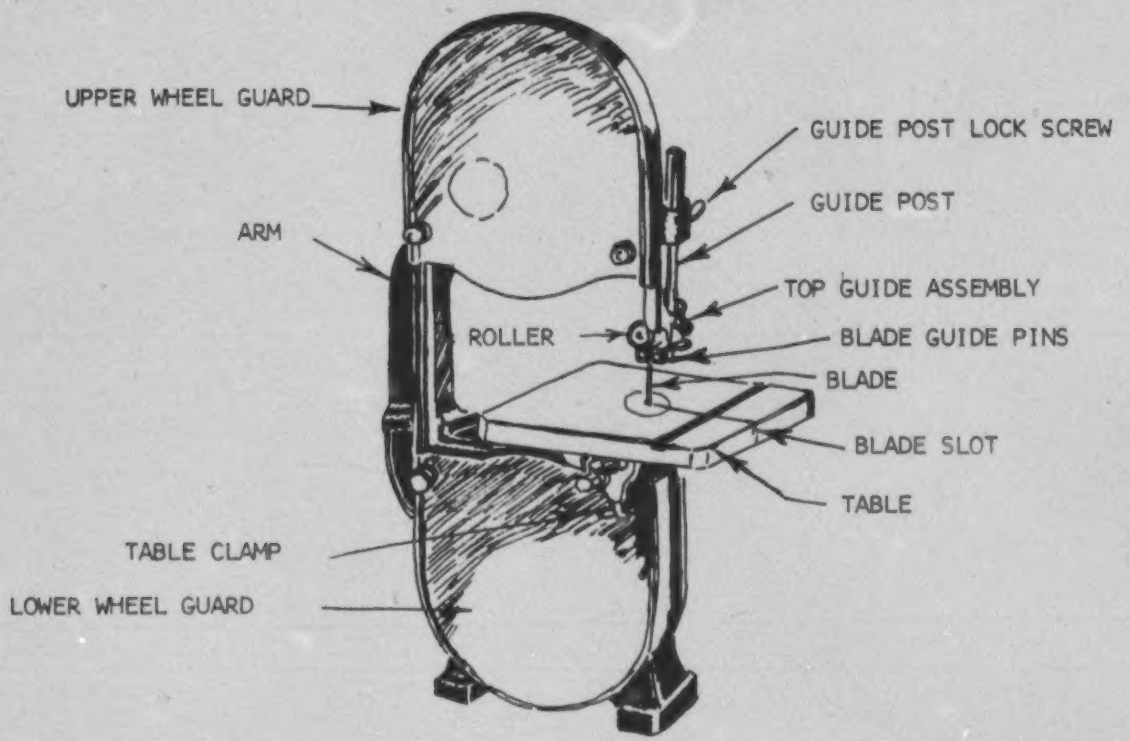
MEDIA RESOURCE LIST

MACHINE ______________________

LOOP FILMS

BOOK REFERENCE LIST

CHARTS AND OTHER AIDS


UPPER WHEEL GUARD
GUIDE POST LOCK SCREW
GUIDE POST
ARM
TOP GUIDE ASSEMBLY
ROLLER
BLADE GUIDE PINS
BLADE
BLADE SLOT
TABLE
TABLE CLAMP
LOWER WHEEL GUARD

BAND SAW (WOOD - METAL)

USES: CUTTING CURVES, RESAW CUTS

SAFETY PROCEDURE:

1. ALWAYS WEAR EYE PROTECTION WHEN OPERATING IN THE MACHINE AREA.
2. WITH THE POWER OFF, ADJUST THE SAW GUIDE TO WITHIN ABOUT 1/8" OF STOCK TO BE CUT BEFORE POWER IS TURNED ON.
3. THE OPERATOR MUST NOT ALLOW HIS FINGERS TO COME CLOSER THAN 2" FROM THE SAW BLADE WHEN CUTTING.
4. NEVER STAND AT THE RIGHT-HAND SIDE OF BANDSAW. A SERIOUS ACCIDENT MIGHT RESULT IF SAW BLADE SHOULD BREAK.
5. IF NECESSARY TO BACK THE STOCK OUT OF A LONG SAW CUT, POWER SHOULD BE TURNED OFF AND THE BLADE ALLOWED TO COME TO A COMPLETE STOP BEFORE REMOVING STOCK.
6. A SHARP CURVE OR SMALL RADIUS SHOULD NOT BE CUT EXCEPT WITH A VERY NARROW BANDSAW BLADE.
7. CYLINDRICAL STOCK LIKE DOWELS SHOULD BE CUT ON THE BANDSAW ONLY WHEN SOME TYPE OF HOLDER, SUCH AS THE CROSSCUTTING GAUGE, IS USED.
8. NO ADJUSTMENTS SHOULD BE MADE WHEN BANDSAW BLADE IS IN MOTION.
9. THIN STOCK MUST NOT BE STOOD ON EDGE TO BE CUT, UNLESS IT IS FIRMLY SUPPORTED BY THE RE-SAW FENCE AGAINST THE DOWNWARD THRUST OF THE SAW BLADE.
10. IF THE BANDSAW BLADE SHOULD BREAK OR COME OFF THE WHEELS WHILE THE MACHINE IS IN OPERATION, IMMEDIATELY TURN OFF POWER AND KEEP CLEAR OF THE BLADE UNTIL IT AND THE WHEELS COME TO A COMPLETE STOP.

11. ALLOW THE BANDSAW TO REACH FULL OPERATING SPEED BEFORE FEEDING STOCK. DO NOT STOP THE MOTION OF THE BLADE WITH STOCK AFTER THE POWER IS SHUT OFF.

USES AND PROCEDURES ARE BASICALLY THE SAME AS ON THE WOOD BAND SAW, EXCEPT: THE BLADE SPEED MUST BE REDUCED FOR CUTTING METAL.

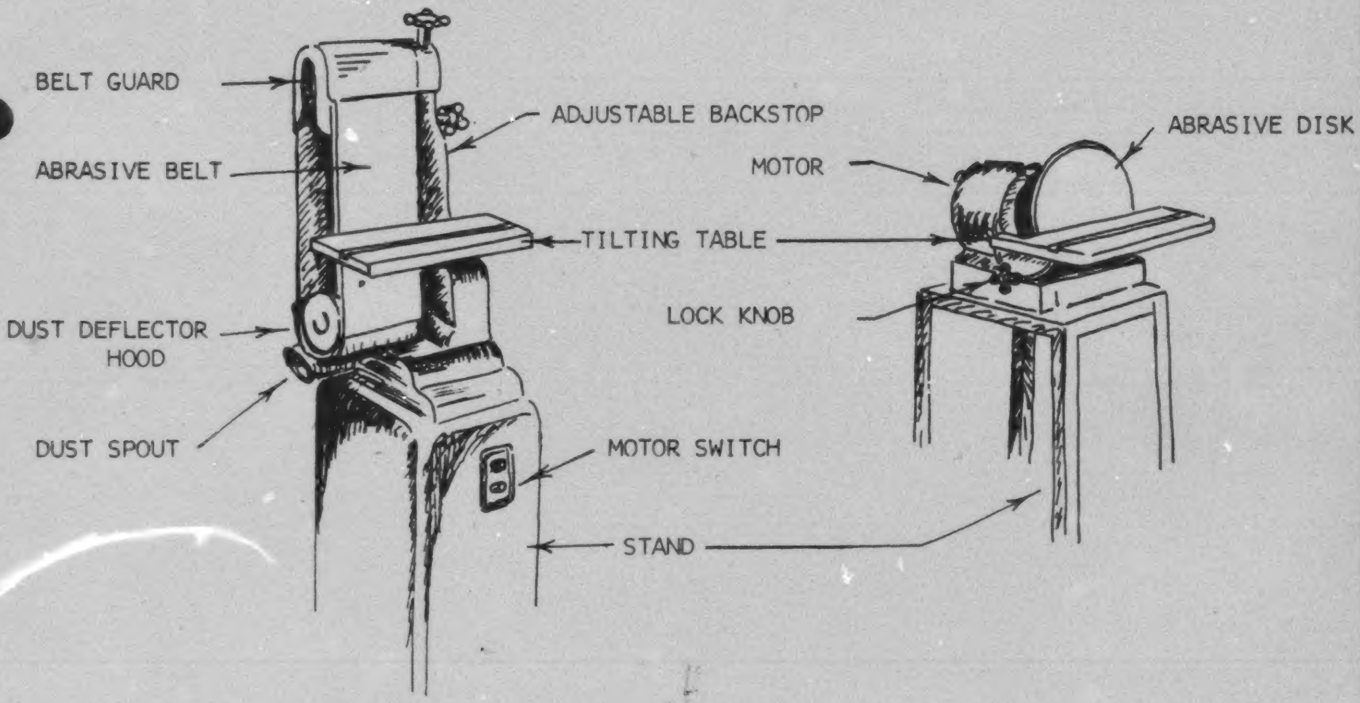
OPERATING PROCEDURE:

1. VISUALLY CHECK ADJUSTMENT OF TOP AND BOTTOM GUIDES. THESE SHOULD BE ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
2. LOWER TOP GUIDE ASSEMBLY TO WITHIN 1/8" OF MATERIAL TO BE CUT. THIS SHOULD BE THE ONLY ADJUSTMENT YOU SHOULD HAVE TO MAKE. (SEE DIAGRAM OF BANDSAW).
3. AFTER OBSERVING PROPER SAFETY PROCEDURES, TURN ON MACHINE.
4. FEED MATERIAL INTO BLADE GENTLY.
5. HANDS SHOULD NOT BE WITHIN 2" OF THE BLADE.
6. WHEN CUTTING CURVES, TURN THE STOCK CAREFULLY SO THAT THE BLADE MAY FOLLOW WITHOUT BEING TWISTED. KEEP HANDS OUTSIDE CUT LINE.
7. IF A CURVE IS SO ABRUPT THAT IT IS NECESSARY TO REPEATEDLY BACK UP AND CUT A NEW KERF, EITHER A NARROW BLADE IS NEEDED OR A BLADE WITH MORE SET IS REQUIRED.
8. REMEMBER, THE SHORTER THE RADIUS TO BE CUT, THE NARROWER THE BLADE TO BE USED.
9. WHEN RESAWING MATERIAL, SET UP A FENCE ON THE BAND SAW TABLE.
10. IN BACKING OUT OF A CUT, THE OPERATOR MUST BE CAREFUL THAT HE DOES NOT ACCIDENTALLY DRAW THE BLADE OFF THE WHEELS.
11. IN CUTTING ROUND STOCK, USE A V BLOCK OR MITER GAUGE TO GUIDE YOUR WORK.

PROCEDURE FOR CHANGING SPEED:

1. UNPLUG THE POWER CORD.
2. OPEN UPPER DOOR AT REAR OF MACHINE.
3. A. FOR SLOW SPEED (METAL CUTTING) PUSH IN AND ROTATE YELLOW SHIFTER KNOB UNTIL IT ENGAGES. CLOSE THE DOOR.

   B. FOR HIGH SPEED (WOOD CUTTING) PULL OUT AND ROTATE YELLOW SHIFTER UNTIL IT ENGAGES. CLOSE THE DOOR.


BELT GUARD
ADJUSTABLE BACKSTOP
ABRASIVE DISK
MOTOR
ABRASIVE BELT
TILTING TABLE
LOCK KNOB
DUST DEFLECTOR HOOD
DUST SPOUT
MOTOR SWITCH
STAND

BELT & DISC SANDER

SAFETY PROCEDURE:

1. DO NOT USE THIS MACHINE AS A "DO ALL" TOOL.
2. WITH THE POWER OFF, CHECK ADJUSTMENT OF THE TABLE AND GUARDS.
3. SAND ONLY PIECES WHICH ARE OF SAFE SIZE. IF YOUR FINGERS ARE WITHIN 1" OF THE ABRASIVE, YOU ARE TOO CLOSE. USE A DIFFERENT TOOL.
4. ALL STOCK SHOULD BE IN CONTACT WITH THE TABLE AND THE BELT AT THE SAME TIME.
5. SANDING IS DONE ON THE DOWN STROKE ONLY.

DISC SANDER

USES: DISC SANDERS ARE USED TO SAND STRAIGHT AND CONVEX CURVES ON EDGE. DIAMETERS OF SANDING DISCS RANGE FROM 8 1/2" TO 18".

OPERATING PROCEDURE:

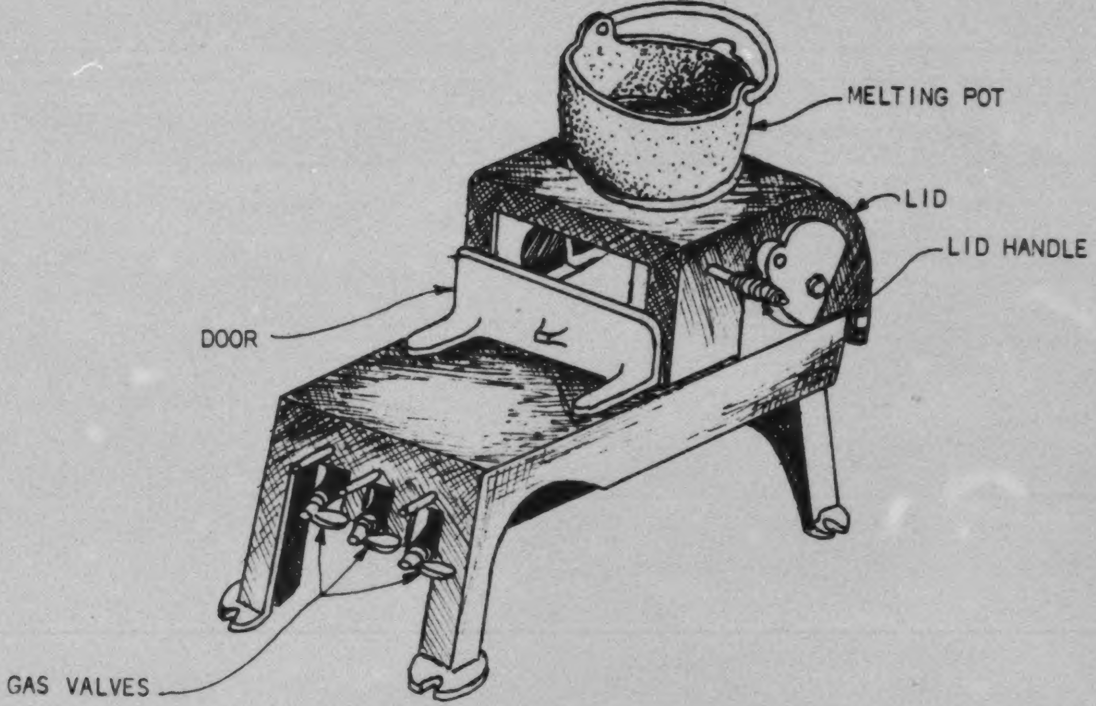
1. PLACE THE WORK ON THE TABLE.
2. MOVE THE WORK INTO CONTACT WITH THE SANDING DISC.
3. SLOWLY MOVE THE WORK ALONG UNTIL ALL WASTE STOCK HAS BEEN REMOVED. KEEP IN MIND THAT SANDERS ARE MAINLY TO SMOOTH SURFACES AND EDGES AND NOT TO REMOVE LARGE QUANTITIES OF STOCK.
4. SAND ON DOWNWARD SIDE ONLY.

STATIONARY BELT SANDER

USES: CAN BE USED FOR FINISHING PRACTICALLY ANY MATERIAL: PLASTIC, METAL, WOOD, CORK, RUBBER -- PROVIDING THE PROPER ABRASIVE BELT IS USED.

OPERATING PROCEDURE:

1. MAKE SURE THE SANDING YOU ARE ABOUT TO DO IS NOT FOR THE PURPOSE OF REMOVING A LARGE AMOUNT OF MATERIAL.
2. CHECK TABLE REST TO SEE IF IT IS SQUARE TO BELT PLATEN.
3. ALL SANDING MUST BE DONE WITH ONE SURFACE RESTING AGAINST TABLE REST. (EXCEPTION IS WHEN SANDING ON IDLER DRUM AT TOP OF SANDER)
4. TURN ON MACHINE AND SAND BY USING A LIGHT BUT FIRM PRESSURE. EXCESSIVE PRESSURE IS UNNECESSARY AND SHOULD BE AVOIDED BECAUSE OF BELT DAMAGE IT CAUSES.
5. MOVE MATERIAL BACK AND FORTH OVER BELT TO KEEP BELT FROM WEARING UNEVEN AND BURNING WOOD.
6. USE A BACK UP BLOCK BEHIND THIN MATERIALS BEING SANDED TO KEEP HANDS AWAY FROM MOVING BELT. FINGERS LESS THAN ONE INCH FROM SANDING BELT ARE TOO CLOSE.



BENCH FURNACE

USES:

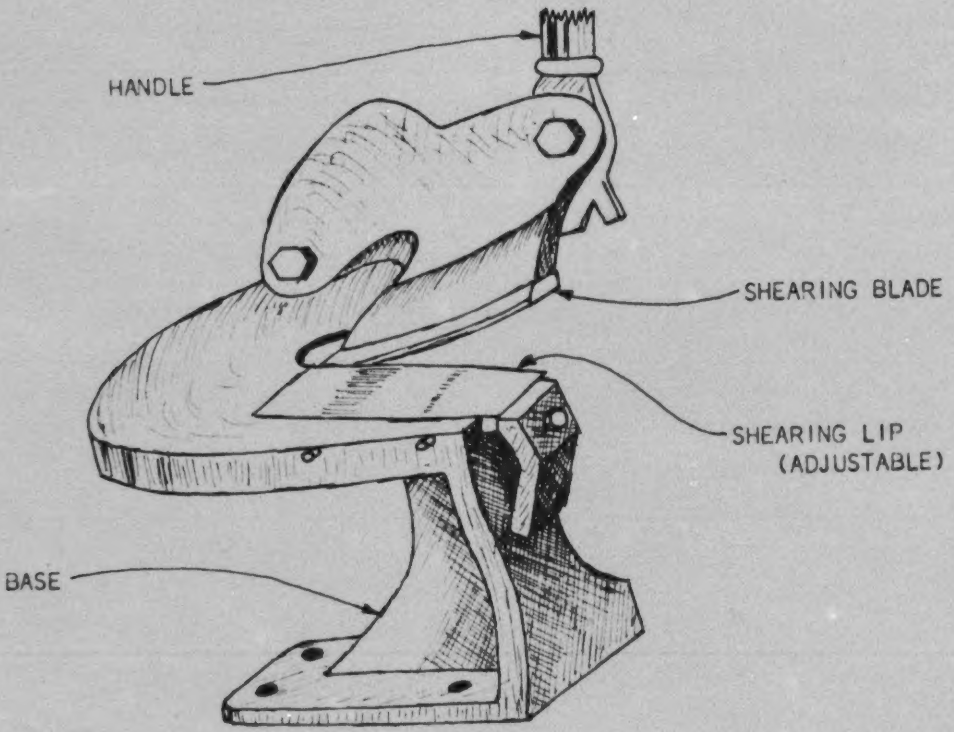
1. HEATING SOLDERING COPPERS.
2. MELTING SOFT METALS.
3. HEATING LIGHT METALS FOR FORGING.
4. HEATING SMALL TOOLS FOR ANNEALING, HARDENING AND TEMPERING.

SAFETY PROCEDURE:

1. DO NOT BLOW OUT THE PILOT LIGHT.
2. BE SURE THAT THE THREE VALVES ARE TURNED OFF WHEN NOT USING THE FURNACE.
3. WEAR GLASSES OR GOGGLES.
4. WEAR ASBESTOS GLOVES WHEN WORKING WITH HOT METALS.

OPERATING PROCEDURE:

1. CHECK ALL VALVES TO SEE THAT THEY ARE SHUT OFF.
2. REMOVE DIRT FROM INSIDE OF FURNACE. (ONLY WHEN FURNACE IS COOL.)
3. OPEN BRANCH LINE VALVE, AT THE REAR OF THE FURNACE.
4. LIGHT A SMALL PIECE OF PAPER TOWEL AND PLACE IN THE FURNACE, THEN TURN ON THE BURNER VALVES.
5. AFTER LIGHTING, CONTROL THE FURNACE BY USING ONLY THE NUMBER OF BURNERS NEEDED. THE SMALL PILOT LIGHTS NEAR EACH BURNER WILL RELIGHT THE GAS WHEN THE FURNACE VALVES ARE TURNED ON.
6. WHEN NOT IN USE, THE BURNER VALVES SHOULD BE TURNED OFF, LEAVING THE PILOT LIGHTS BURNING. AT THE END OF THE DAY THE BRANCH LINE VALVE SHOULD BE TURNED OFF.



BEVERLY SHEARS

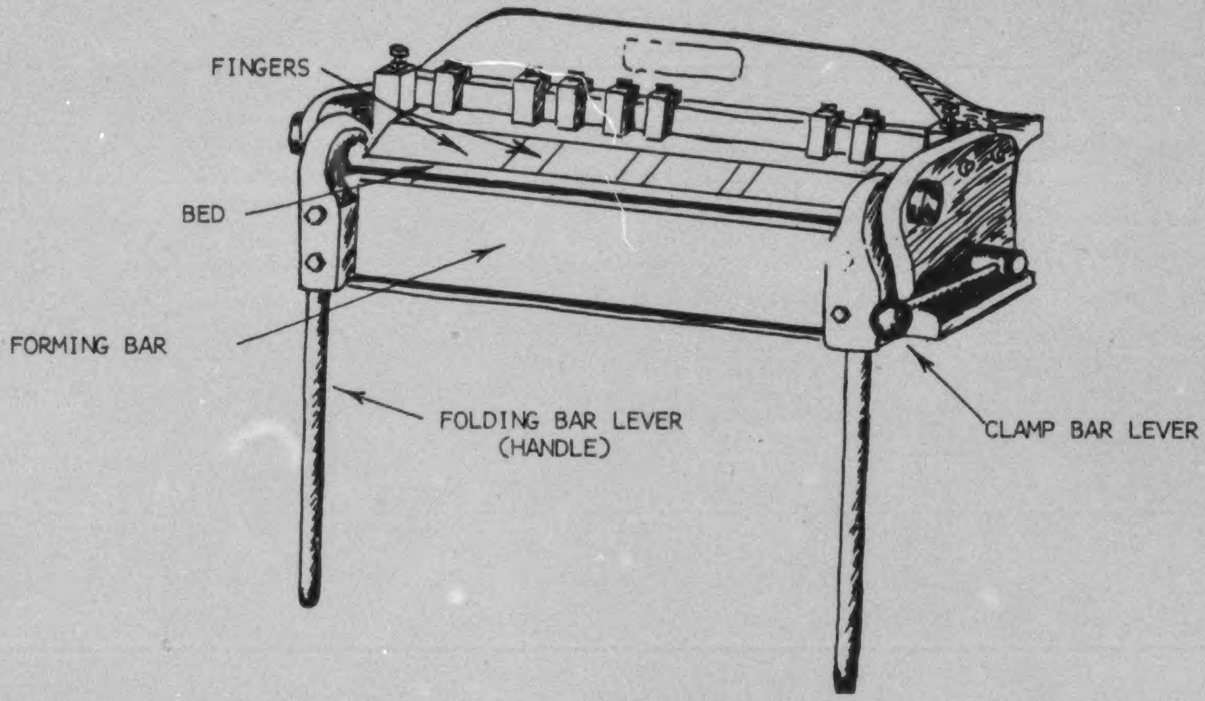
USES: FOR MAKING STRAIGHT OR IRREGULAR CUTS ON SHEET METAL.

SAFETY PROCEDURE:

1. KEEP YOUR FINGERS AWAY FROM THE BLADES.
2. AVOID SLIDING YOUR HANDS ON THE EDGE OFTHE SHEET METAL YOU ARE CUTTING.
3. LEAVE HANDLE IN UPRIGHT POSITION WHEN NOT IN USE.

OPERATING PROCEDURE:

1. INSERT METAL INTO SHEARS AS FAR AS POSSIBLE.
2. ALIGN YOUR MARK ON THE LOWER BLADE.
3. PULL ON HANDLE TO CUT.
4. WHEN CUTTING AN IRREGULAR SHAPE, CONSTANTLY MOVE THE STOCK AS YOU CUT, FOLLOWING THE LAYOUT LINE.
5. MAXIMUM THICKNESS OF STOCK TO BE CUT IS 16 GA. MILD STEEL.
6. NEVER CUT NAILS, RIVETS, BOLTS OR WIRE WITH THE BEVERLY SHEARS.

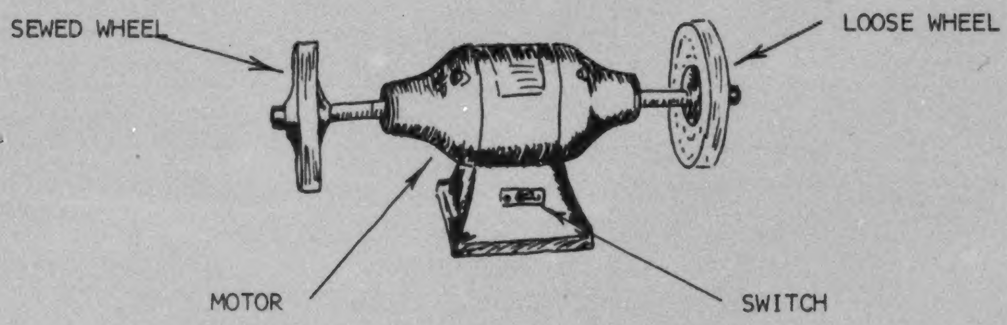

FINGERS
BED
FORMING BAR
FOLDING BAR LEVER
(HANDLE)
CLAMP BAR LEVER

BRAKE (BOX AND PAN)

USES: THE BOX AND PAN BRAKE IS USED TO BEND AND FORM SHEET METAL. IT IS VERY USEFUL, BECAUSE OF THE REMOVABLE FINGERS, WHEN YOU HAVE TO BEND ALL FOUR SIDES SUCH AS IN A BOX OR PAN.

SAFETY AND OPERATING PROCEDURE:

1. ONE PERSON AT A TIME IS TO OPERATE THIS MACHINE.
2. LIFT THE CLAMPING BAR HANDLE AND INSERT THE METAL IN THE BRAKE.
3. LIFT THE BENDING WING UNTIL THE DESIRED ANGLE IS SECURED.
4. IF IT IS NECESSARY TO ADJUST THE FINGERS, DO THIS BEFORE THE METAL IS INSERTED INTO THE MACHINE.



BUFFER

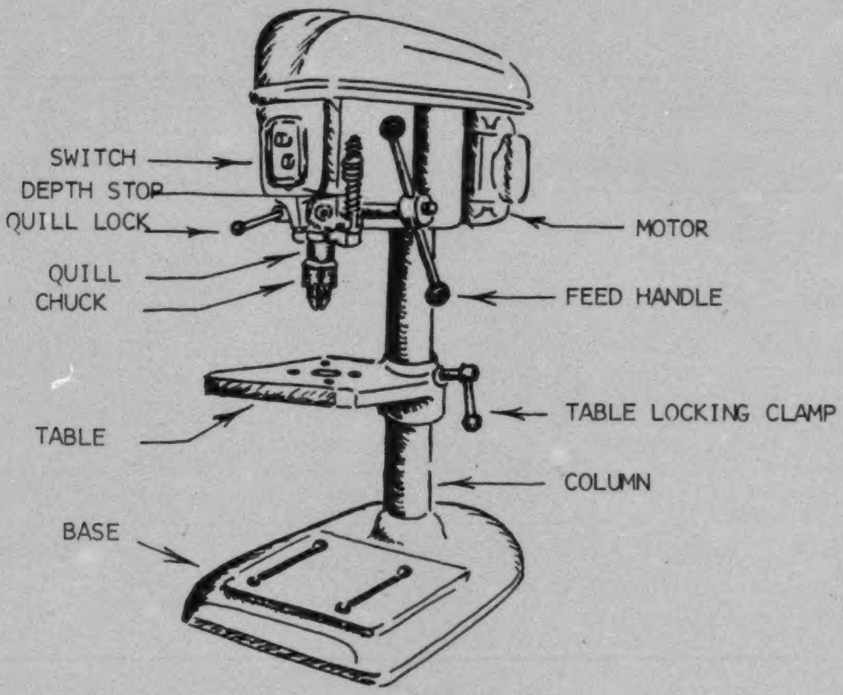
USES: FOR SMOOTHING AND POLISHING MATERIALS.

SAFETY PROCEDURE:

1. ALWAYS USE EYE SHIELDS AND GOGGLES.
2. NEVER LET THE TOP EDGE OF THE MATERIAL COME IN CONTACT WITH THE WHEEL BECAUSE IT MAY BE PULLED FROM YOUR HANDS.

OPERATING PROCEDURE:

1. APPLY A SMALL AMOUNT OF BUFFING COMPOUND ON THE SEWN WHEEL.
   NOTE: USE DIFFERENT BUFFING COMPOUNDS AND MACHINES FOR BUFFING PLASTIC AND METAL. DON'T MIX THEM.
2. MOVE THE MATERIAL ACROSS THE FACE OF THE WHEEL.



DRILL PRESS

USES: THE DRILL PRESS IS USED FOR DRILLING AND BORING HOLES. IT SUBSTITUTES AS A SANDER AND MORTISER.

SAFETY PROCEDURE:

1. BEFORE PLACING THE DRILL OR BIT IN THE DRILL PRESS CHUCK, CHECK THE SPEED BY LOOKING AT THE PULLEY.
2. MATERIAL OF A SIZE OR SHAPE WHICH MIGHT BE SEIZED BY THE TURNING DRILL MUST BE CLAMPED IN PLACE TO THE DRILL PRESS TABLE. WHEN IN DOUBT, CLAMP IT ON.
3. WHEN SETTING UP THE DRILL PRESS, MAKE CERTAIN THE BIT OR DRILL DOES NOT STRIKE THE TABLE. USE A SCRAP OF WOOD TO BACK UP THE PART TO BE DRILLED.
4. ALWAYS REMOVE THE CHUCK KEY AFTER TIGHTENING OR REMOVING A DRILL OR BIT. THE CHUCK KEY SHOULD NEVER BE IN THE CHUCK WITHOUT YOUR HAND ON THE KEY.
5. USE A V BLOCK WHEN DRILLING ROUND WOOD, METAL OR PLASTIC STOCK.
6. CENTER PUNCH ALL LOCATIONS WHEN DRILLING.
7. USE A SHARP BIT. DON'T FORCE A DULL BIT.

OPERATING PROCEDURE:

1. CHECK THE DRILL PRESS SPEED FOR THE SIZE OF THE DRILL TO BE USED.
2. INSERT THE DRILL IN THE CHUCK. NEVER LEAVE CHUCK KEY IN CHUCK.
3. CLAMP THE STOCK TO BE DRILLED TO THE DRILL PRESS TABLE. USE A PIECE OF WOOD UNDER THE STOCK.
4. ADJUST THE DEPTH GAUGE TO THE DESIRED DEPTH OF THE HOLE TO BE BORED.

DRILL PRESS (CON'T)

METALS

1. In general, our drills are used at low speeds. The hardness of stock being drilled is also a factor in selecting the speed.
2. Check the drill press speed for the size of the drill to be used.
3. Too slow a feed will overheat the drill by friction and too fast a feed may cause excessive pressure which may break the drill or tear the stock.

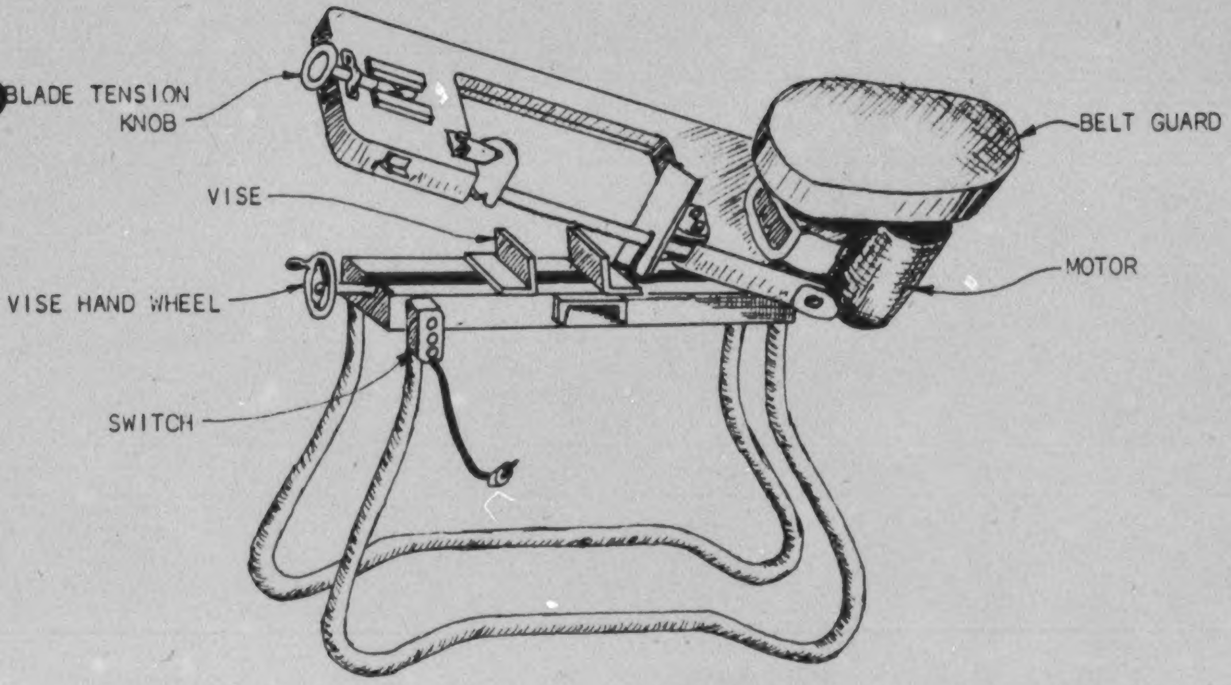
SPECIAL OPERATIONS:

Using a mortising attachment

1. Check drill press speed for the mortising attachment. (Generally a slower speed is used than in regular boring.)
2. Change drill press chuck to the mortising spindle.
3. Mount the fence and hold down fingers on the drill press table.
4. Adjust the depth gauge to the desired depth.
5. Start cuts at the end of the mortise and make cuts next to each other until all waste material has been removed.
6. Remove mortiser attachment from drill press.

Using a sanding drum

1. Check the drill press belt for low speed.
2. Fasten the sanding drum in the chuck. Never leave chuck key in chuck.
3. Fasten a wood table plate to the drill press table with sanding drum to fit into hole in the wood plate.
4. Lock the quill to the desired depth.
5. Hold the work flat on the table and sand with a light, steady pressure.
6. Remove sanding drum from drill press. Never leave chuck key in chuck.



HORIZONTAL BAND SAW

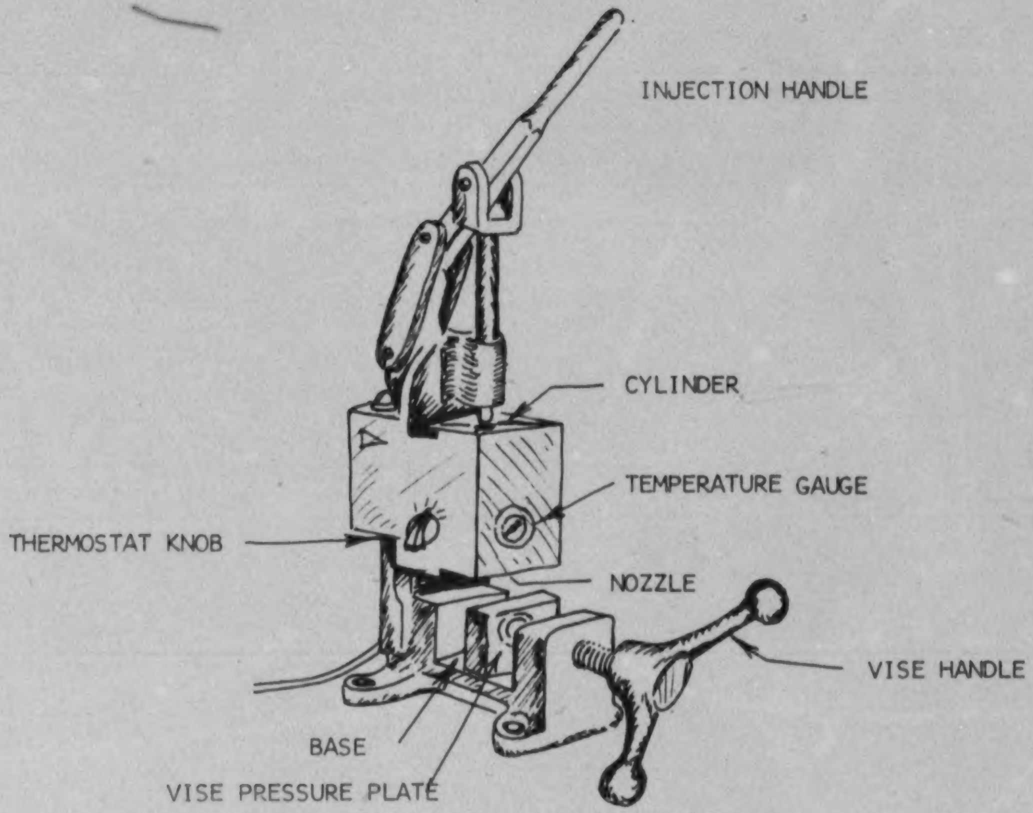
USES: CUTTING FERROUS AND NONFERROUS METALS.

SAFETY PROCEDURE:

1. ALWAYS WEAR EYE PROTECTION WHEN OPERATING IN THE MACHINE AREA.
2. IF THE BANDSAW BLADE SHOULD BREAK OR COME OFF THE WHEELS WHILE THE MACHINE IS IN OPERATION, TURN OFF THE POWER AND KEEP CLEAR OF THE BLADE UNTIL IT COMES TO A COMPLETE STOP.
3. THIN STOCK MUST BE LAID FLAT IN THE VISE.

OPERATING PROCEDURE:

1. RAISE FRAME UNTIL RATCHET DOG WILL CATCH ON THE RATCHET FRAME.
2. PLACE MATERIAL IN VISE AND LOWER THE FRAME UNTIL THE BLADE JUST CLEARS THE TOP OF THE MATERIAL. NOW MOVE THE METAL BACK AND FORTH UNTIL THE CUTOFF LINE IS UNDER THE SAW BLADE. RAISE FRAME AGAIN.
3. TIGHTEN THE VISE WITH THE HAND WHEEL.
4. START MOTOR AND GENTLY LOWER FRAME UNTIL THE BLADE CONTACTS THE MATERIAL.
5. THE SAW WILL SHUT OFF WHEN THE CUT IS FINISHED.
6. RETURN UNNEEDED MATERIAL TO STORAGE.


INJECTION HANDLE
CYLINDER
TEMPERATURE GAUGE
THERMOSTAT KNOB
NOZZLE
VISE HANDLE
BASE
VISE PRESSURE PLATE

INJECTION MOLDER

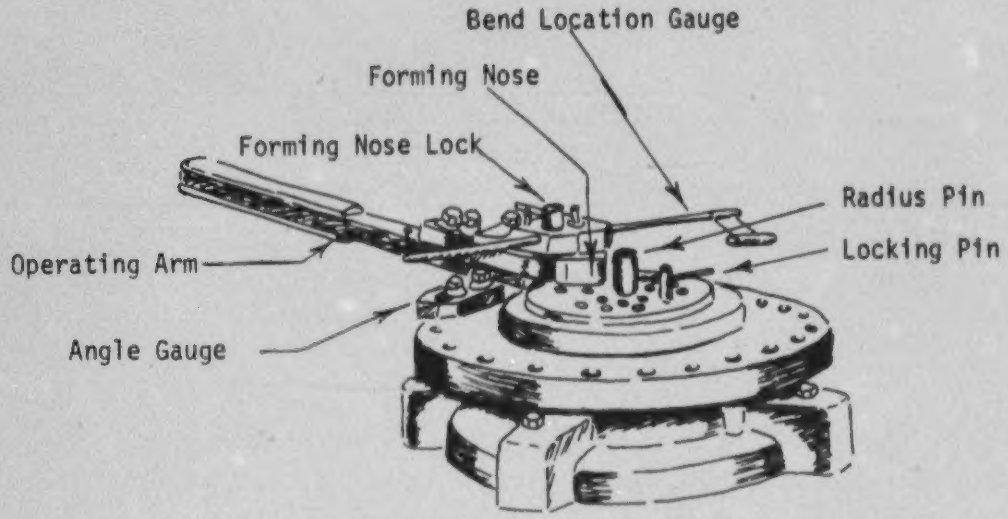
USES: MOLDING OF THERMOPLASTIC MATERIAL.

SAFETY PROCEDURE:

1. WEAR GLASSES OR GOGGLES.
2. DO NOT TOUCH HEATING CYLINDER WHEN MACHINE IS ON.

OPERATING PROCEDURE:

1. TURN THERMOSTAT KNOB ON TO MEDIUM HIGH TEMPERATURE 300°-400° F. WAIT UNTIL CORRECT TEMPERATURE BEFORE OPERATING MACHINE.
2. PLACE MOLD IN VISE, DO NOT OVERTIGHTEN, SO SPRUE HOLE IS DIRECTLY UNDER NOZZLE.
3. FILL CYLINDER WITH PLASTIC AT FUNNEL WITH A SPOON. BE CAREFUL NOT TO SPILL.
4. ALLOW PLASTIC MATERIAL TO BECOME FLUID.
5. PLACE HAND ON INJECTION HANDLE, STAND BACK AND WITH ONE MOTION PULL HANDLE DOWN. WHEN RESISTANCE IS FELT, MOLD IS FULL. WAIT 3 SECONDS BEFORE RAISING HANDLE BACK UP.
6. LET MOLD COOL FOR ABOUT 15 SECONDS.
7. RECHARGE CYLINDER BEFORE EACH INJECTION.
8. UNLOCK AND REMOVE MOLD, CUT OFF SPRUE.
9. CLEAN AND PUT AWAY ALL MATERIALS.

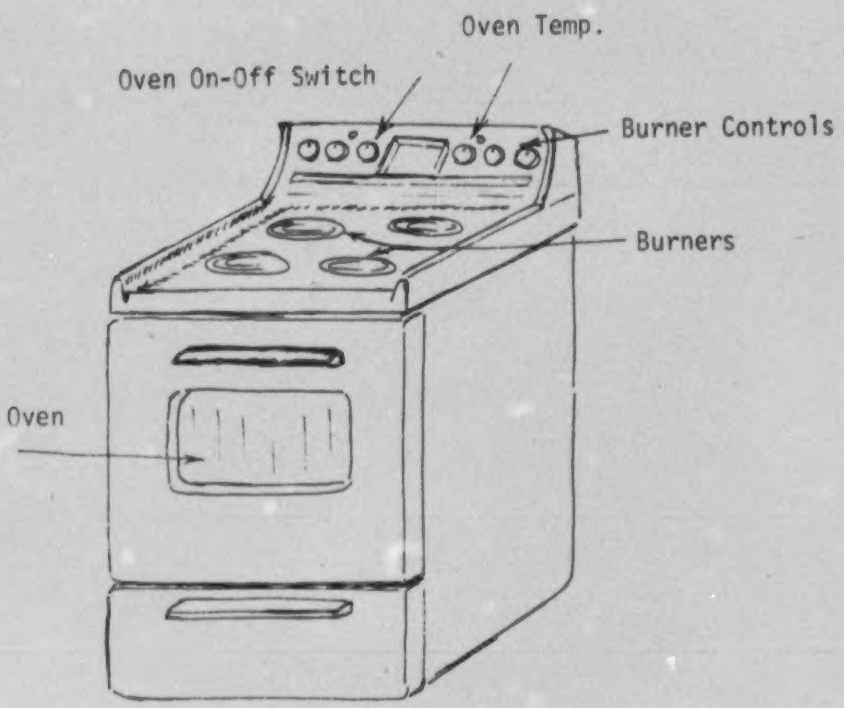


BENDER - DI ARCO

USES: TO PRODUCE A VARIETY OF BENDS, AND HANDLE DIFFERENT SHAPES OF METAL BY INTERCHANGING THE VARIOUS RADIUS FORMING ACCESSORIES.

OPERATING AND SAFETY PROCEDURES:

1. DO NOT EXCEED THE BENDING LIMITATIONS OF THIS MACHINE.
2. USE THE CORRECT ACCESSORY BLOCK FOR THE PARTICULAR BENDING OPERATION YOU ARE GOING TO DO.
3. DO NOT TRY TO BEND SPRING STEEL OR EXCEPTIONALLY HARD METALS SUCH AS TOOL STEEL.
4. TO SET UP FOR A BEND, FIRST LOOSEN THE NOSE HOLDER AND HOLDER SUPPORT BOLTS AND SLIDE THE NOSE HOLDER IN OR OUT DEPENDING ON THE RADIUS FORM TO BE USED.
5. NEXT, INSTALL THE RADIUS FORM.
6. PLACE THE METAL TO BE BENT AGAINST THE RADIUS FORM AND PLACE THE LOCKING PIN IN THE APPROPRIATE HOLE. THE METAL SHOULD FIT SNUGLY BETWEEN THE RADIUS FORM AND LOCKING PIN.
7. SLIDE THE FORMING NOSE UP TO THE METAL (CHECK THE DI ARCO BENDING BOOKLET FOR THE PARTICULAR OPERATION TO BE DONE.)
8. LOCK THE FORMING NOSE AND NOSE SUPPORT INTO PLACE.
9. CENTER THE BEND AND SET THE BEND LOCATING GAUGE, IF ONE IS AVAILABLE. MARK THE START OF BEND WITH CHALK.
10. LOCK THE NOSE INTO POSITION WITH THE NOSE LOCK.
11. CHECK THE OPERATING ARM FOR FREE MOVEMENT. IF IT MOVES STIFFLY, APPLY GREASE THROUGH THE GREASE FITTING.
12. WITH THE METAL INSTALLED, SLOWLY MOVE THE OPERATING ARM UNTIL YOU HAVE THE APPROXIMATE BEND. REMEMBER THAT METAL TENDS TO SPRING BACK SOMEWHAT WHEN BENDING PRESSURE IS RELEASED, SO YOU MAY HAVE TO BEND A LITTLE BEYOND TO ALLOW FOR SPRING-BACK.
13. USE CARE WHEN BENDING LONG OR AWKWARD OBJECTS TO PREVENT INJURY.
14. CHECK THE DI ARCO BOOKLET FOR EACH PARTICULAR OPERATION YOU WISH TO DO. DETAILED STEP-BY-STEP DIRECTIONS ARE GIVEN IN THIS BOOKLET.


Oven Temp.
Oven On-Off Switch
Burner Controls
Burners
Oven

OVEN

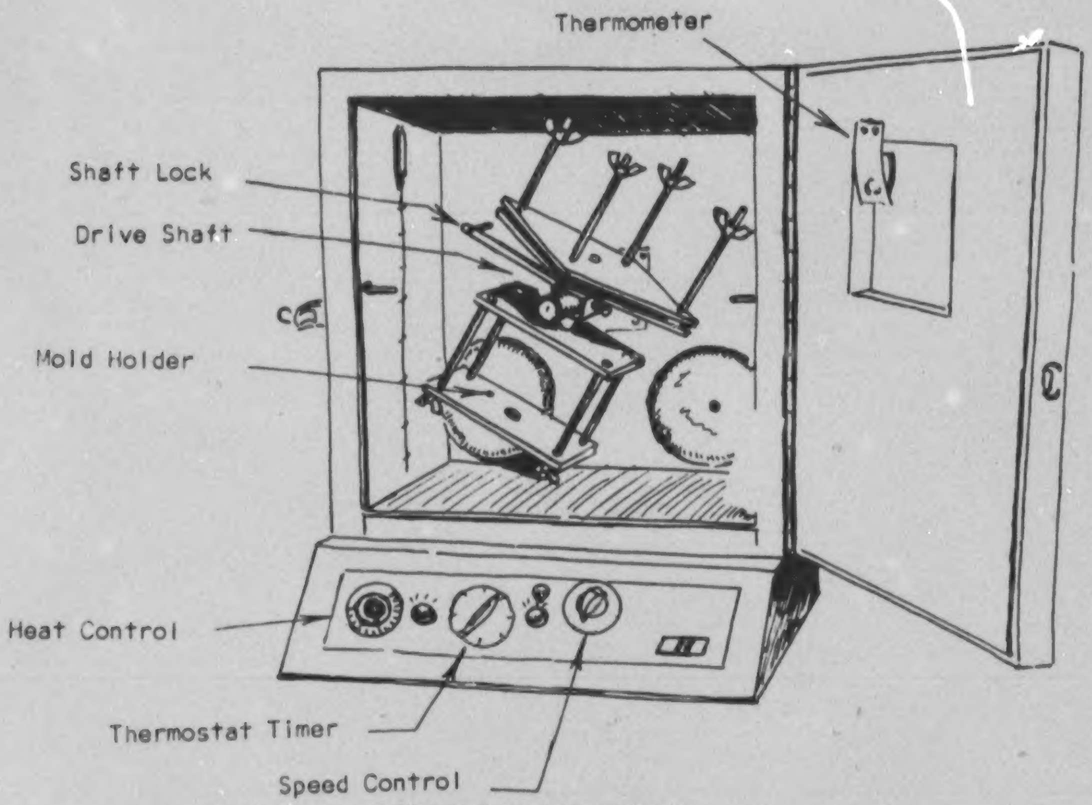
USES:

1. HEAT PLASTIC CUBES.
2. HEAT ACRYLICS FOR BENDING AND SHAPING.
3. EXPAND BEADS.
4. CURE EXPANDED PROJECTS.
5. TOOL DIP PROCESS.

CONSULT INSTRUCTOR FOR OTHER USES.

OPERATING AND SAFETY PROCEDURE:

1. ASSUME THE MATERIAL IN THE OVEN TO BE HOT AND HANDLE ACCORDINGLY.
2. DO NOT OVERHEAT YOUR MATERIAL.



ROTATIONAL MOLDER

USES: PRODUCE COMPLETELY ENCLOSED, HOLLOW, SEAMLESS OBJECTS.
EXAMPLES: PLASTIC FRUIT, SQUEEZE BULBS, TOILET FLOATS & BALLS.

SAFETY PROCEDURE:

1. USE GLOVES WHEN REMOVING MOLDS FROM OVEN.
2. HEAT MUST BE OFF WHILE SPRAYING MOLD WITH WATER.

OPERATING PROCEDURE:

1. MAKE THE MOLD. A COMPLETELY CLOSED TWO-PIECE MOLD MADE OF CAST ALUMINUM OR COPPER.
2. PREPARE THE MOLD. CLEAN INSIDE OF MOLD BEFORE POLISHING OR APPLYING MOLD RELEASE.
3. FILL THE MOLD WITH A PRE-MEASURED AMOUNT OF PLASTISOL--1/4 BY VOLUME WITH LIQUID PLASTISOL.
4. PLACE THE CLOSED MOLD IN THE DUAL-MOLD HOLDER, AND PLACE ASSEMBLED HOLDER ON THE MOTOR SHAFT AND LOCK IN PLACE. CLOSE DOOR.
5. HEAT THE MOLD AS IT IS ROTATED. THE HEAT IS TURNED ON BY SETTING THE TIMER AT 25 MINUTES AND THE THERMOSTAT DIAL AT 400° F. MOTOR SWITCH IS THEN TURNED ON SO THAT THE MOLDS ARE SIMULTANEOUSLY ROTATED AROUND TWO AXES IN PLANES AT RIGHT ANGLES TO EACH OTHER. APPROXIMATELY 15 RPM.
6. CURE THE PLASTISOL. IN MANY CASES IT WILL BE COMPLETELY CURED IN THE ROTATION PROCESS.
7. WHEN THE TIMER SHUTS OFF, OPEN THE DOOR AND SPRAY THE MOLD WITH A FINE MIST WATER SPRAY. SPRAY UNTIL DROPLETS DO NOT BOIL OFF.

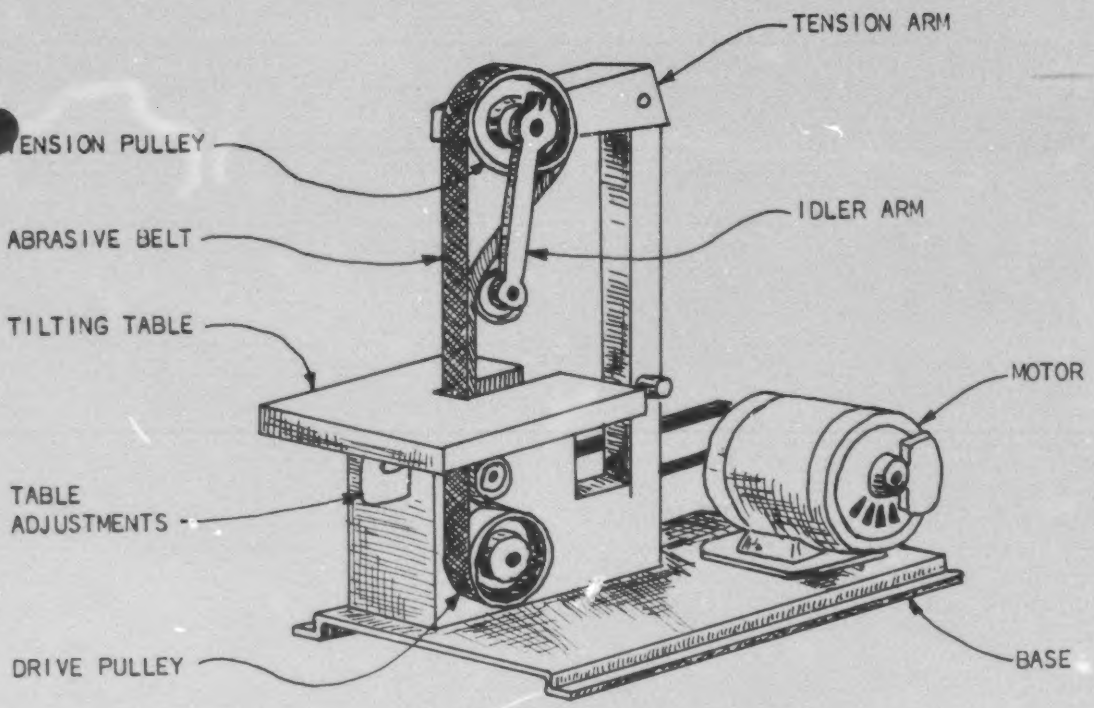
ROTATIONAL MOLDER (CON'T)

8. STOP ROTATION. WITH GLOVES, REMOVE MOLD HOLDER BY TURNING BLACK POINTER HANDLE OUT (180 DEGREES), AND SLIDE MOLD HOLDER OFF MOTOR DRIVEN SHAFT. DIP HOLDER IN PAIL OF COOL WATER.
9. REMOVE MOLDS FROM HOLDER.
10. OPEN TWO PIECE MOLD AND REMOVE PROJECT.

NOTES:

IF HOLDING (PROJECT) STICKS TO MOLD, USE TWO (2) 1/4-20 THUMB SCREWS TO PART MOLDS.

IF MOLDED PROJECT IS POROUS, IT MAY BE CAUSED BY MOISTURE IN THE MOLD PORES. DRY MOLD COMPLETELY AND REPEAT CYCLE.


TENSION ARM
ENSION PULLEY
IDLER ARM
ABRASIVE BELT
TILTING TABLE
MOTOR
TABLE ADJUSTMENTS
DRIVE PULLEY
BASE

SANDER-GRINDER

USES: THE SANDER-GRINDER CAN BE USED FOR SANDING, SHARPENING, CONTOURING, DEBURRING, GRINDING, FINISHING AND POLISHING WOOD, METALS, PLASTICS AND OTHER MATERIALS PROVIDING THE PROPER ABRASIVE BELT IS USED.

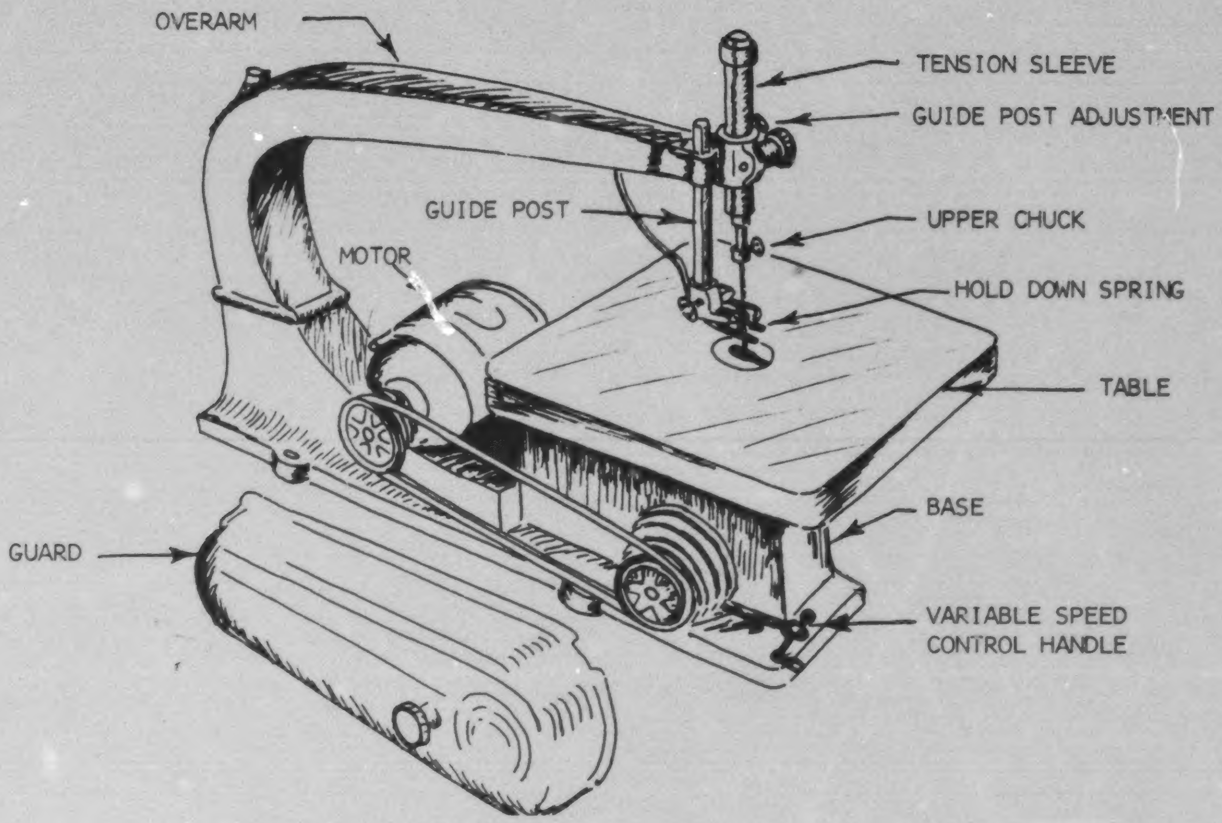
SAFETY PROCEDURE:

1. DO NOT USE THIS MACHINE AS A "DO ALL" TOOL.
2. MAKE ALL ADJUSTMENTS WITH THE POWER TURNED OFF.
3. ALWAYS WEAR SAFETY GOGGLES.
4. ROLL UP LONG SLEEVES AND REMOVE GLOVES BEFORE OPERATING MACHINE.
5. NEVER HOLD YOUR WORK WITH A RAG WHEN SANDING.
6. KEEP YOUR HANDS AWAY FROM MOVING PARTS OF THE MACHINE.

OPERATING PROCEDURE:

1. MAKE SURE THE SANDING YOU ARE ABOUT TO DO IS NOT FOR THE PURPOSE OF REMOVING A LARGE AMOUNT OF MATERIAL.
2. CHECK ADJUSTMENT OF TABLE REST FOR YOUR PARTICULAR SANDING OPERATION.
3. MOST SANDING IS DONE WITH ONE SURFACE RESTING AGAINST THE TABLE REST.
4. SELECT AND INSTALL PROPER ABRASIVE BELT FOR YOUR PARTICULAR SANDING OPERATION.
5. CHECK TO SEE THAT THE ABRASIVE BELT IS TRACKING PROPERLY ON THE PULLEYS.

6. TURN ON MACHINE AND SAND BY USING A LIGHT BUT FIRM PRESSURE. EXCESSIVE PRESSURE SHOULD BE AVOIDED BECAUSE OF POSSIBLE ABRASIVE BELT DAMAGE.
7. A LUBRICANT SHOULD BE USED WHEN GRINDING ALUMINUM TO AVOID CLOGGING THE ABRASIVE BELT.


OVERARM
TENSION SLEEVE
GUIDE POST ADJUSTMENT
GUIDE POST
UPPER CHUCK
MOTOR
HOLD DOWN SPRING
TABLE
BASE
GUARD
VARIABLE SPEED CONTROL HANDLE

SCROLL SAW

USES: INSIDE CUTS, IRREGULAR THIN MATERIAL.

SAFETY PROCEDURE:

1. CHECK THE ADJUSTMENT OF BLADE SUPPORT, BLADE GUIDE, AND HOLD DOWN, USING GUIDE POST LOCKING THUMB SCREW.
2. TURN MACHINE THROUGH ONE CYCLE BY HAND TO BE SURE OF CHUCK CLEARANCE.
3. OPERATE AT THE PROPER SPEED FOR YOUR WORK.
4. KEEP THE MACHINE CLEAR OF TOOLS AND STOCK.
5. DO NOT FORCE THE STOCK INTO THE BLADE.
6. KEEP FINGERS AWAY FROM BLADE AND PULLEY WHEN MACHINE IS IN OPERATION.
7. THIS MACHINE IS NOT TO BE USED FOR CUTTING STOCK OVER 1".
8. THE DANGER AREA IS IN THE SAW LINE. KEEP FINGERS OUTSIDE THIS LINE.

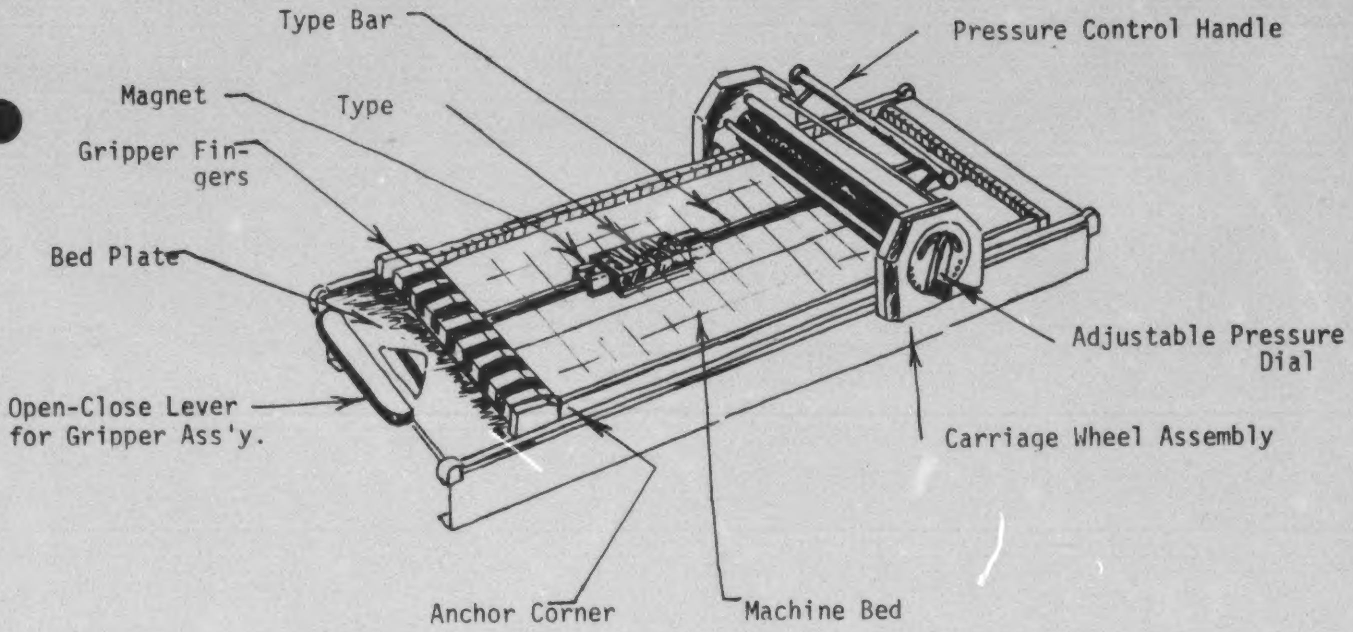
OPERATING PROCEDURE:

1. JIG SAW BLADES VARY IN LENGTH, THICKNESS, AND NUMBER OF TEETH PER INCH. BE SURE THE TEETH OF THE BLADE ARE POINTING TOWARD THE TABLE.
2. LOWER THE HOLD DOWN (SEE DRAWING) SO THE SPRING TENSION OF THE HOLD DOWN HOLDS THE WORK ON THE TABLE. THIS SHOULD BE THE ONLY ADJUSTMENT YOU SHOULD HAVE TO MAKE.
3. TURN THE MOTOR DRIVE SHAFT ONE REVOLUTION BY HAND TO CHECK ALL ADJUSTMENTS.

4. AFTER ADJUSTMENTS ARE COMPLETE, START THE MACHINE AND FEED THE WORK FORWARD EVENLY ON THE WASTE SIDE OF THE CUTTING LINE.

CUTTING INSIDE WORK:

1. WHEN YOU MAKE INSIDE CUTS, DRILL A HOLE IN THE WASTE AREA OF THE DESIGN.
2. DISCONNECT THE BLADE FROM TOP CHUCK, TURN DRIVESHAFT UNTIL BLADE IS AT ITS LOWEST POINT, RAISE HOLD DOWN TO ITS HIGHEST POINT AND PLACE MATERIAL OVER BLADE. LOWER HOLD DOWN ON TO THE MATERIAL, RECONNECT BLADE, THEN READJUST HOLD DOWN AND TURN THE DRIVE SHAFT ONE REVOLUTION TO CHECK THE ADJUSTMENT.

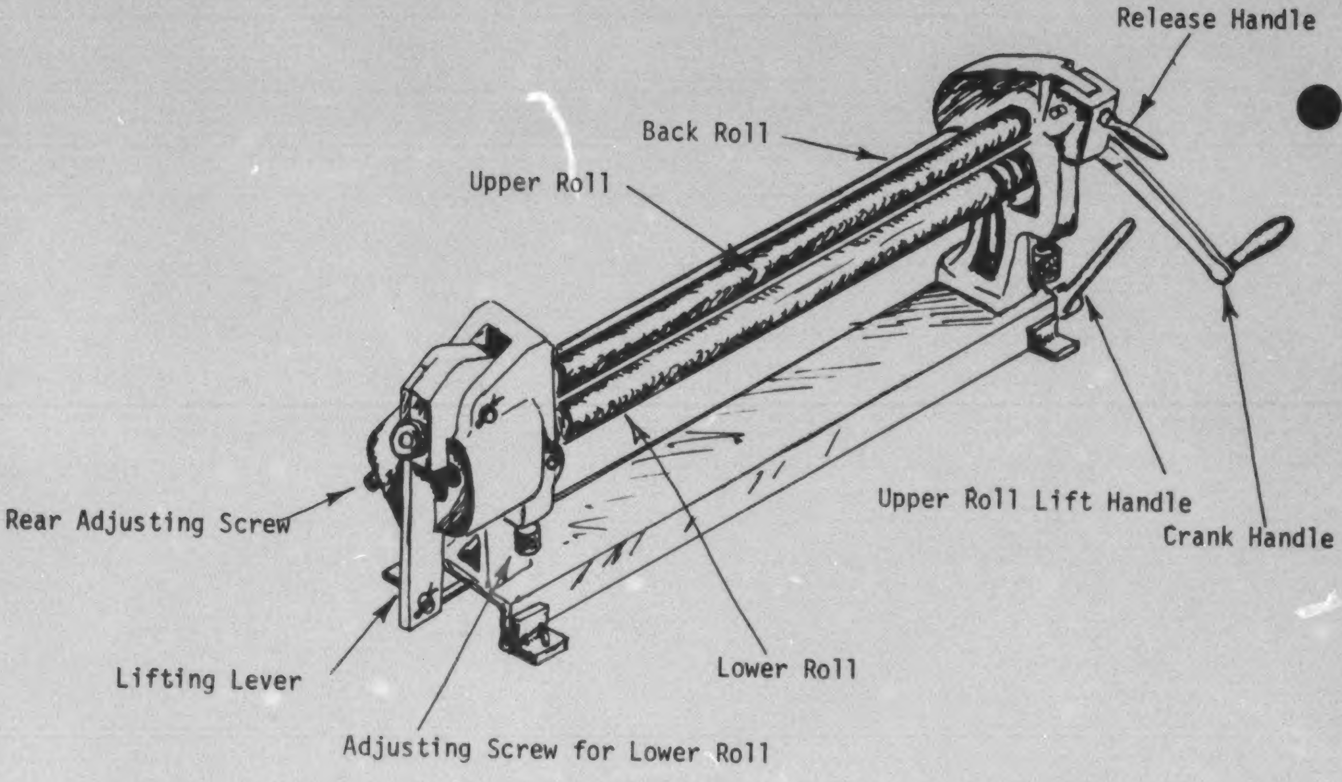

Type Bar
Pressure Control Handle
Magnet
Type
Gripper Fingers
Bed Plate
Adjustable Pressure Dial
Open-Close Lever for Gripper Ass'y.
Carriage Wheel Assembly
Anchor Corner
Machine Bed

SIGN PRESS

USES: RELIEF PRINTING

OPERATING AND SAFETY PROCEDURE:

1. PLACE THE TYPE ON THE MACHINE BED. SPELL THE WORDS FROM RIGHT TO LEFT.
2. PLACE THE BARS OF FURNITURE BETWEEN ROWS OF TYPE. PLACE AT LEAST ONE PADDED SIDE TOWARDS EACH ROW OF TYPE.
3. IF DIFFERENT SIZED LETTERS ARE USED IN THE SAME ROW, ADDITIONAL SPACES MAY BE ADDED.
4. CENTER THE TYPE USING THE GRID ON THE MACHINE BED.
5. FILL THE MACHINE BED WITH FURNITURE AND TIGHTEN THE QUION (AN EXPANDABLE BAR) UNTIL THE TYPE IS HELD SNUGLY.
6. PLACE A SMALL AMOUNT OF INK ON THE GLASS PLATEN.
7. SPREAD A THIN COAT OF INK OVER THE GLASS USING A COMPOSITION ROLLER. IF TWO COLORS ARE DESIRED, TWO ROWS OF INK WILL BE REQUIRED.
8. ROLL A THIN COAT OF INK ON THE TYPE USING THE ROLLER.
9. CUT THE CARD STOCK TO THE PROPER SIZE.
10. PLACE THE CARD STOCK UNDER THE GRIPPERS AGAINST THE ANCHOR CORNER.
11. ADJUST THE PRESSURE DIAL TO THE RIGHT PRESSURE.
12. SLIDE THE ROLLER OVER THE ENTIRE CARD FOR EACH COPY WANTED.
13. CLEAN THE TYPE WHILE THEY ARE STILL IN THE MACHINE. CLEAN UP YOUR MESS.


Release Handle
Back Roll
Upper Roll
Rear Adjusting Screw
Upper Roll Lift Handle
Crank Handle
Lifting Lever
Lower Roll
Adjusting Screw for Lower Roll

FORMING MACHINE (SLIP-ROLL)

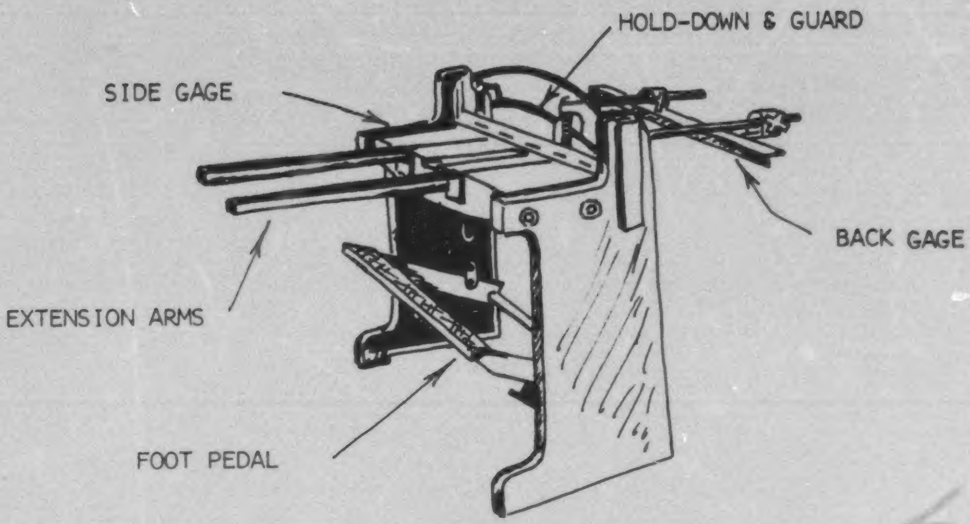
USES: THE FORMING MACHINE IS USED TO FORM CYLINDERS AND CONES, SUCH AS STOVE PIPES, CANS, ETC.

SAFETY PROCEDURE:

1. ONE PERSON AT A TIME IS TO OPERATE THIS MACHINE.
2. MAXIMUM THICKNESS, 22 GAUGE STEEL.

OPERATING PROCEDURE:

1. LOCK THE TOP FRONT ROLL IN POSITION, AND ADJUST THE LOWER ROLL SO YOU CAN SLIP THE METAL BETWEEN THE TWO ROLLS.
2. WHILE TURNING THE HANDLE, RAISE METAL SLIGHTLY AND THEN LOWER IT TO CATCH THE REAR ROLL.
3. ADJUST BACK ROLL TO OBTAIN CORRECT DIAMETER OF WORK.
4. UNLOCK TOP ROLL TO TAKE OUT MATERIAL.
5. IF YOU HAVE A WIRE EDGE, PUT WIRE EDGE INTO GROOVES AT EDGE OF ROLLS.

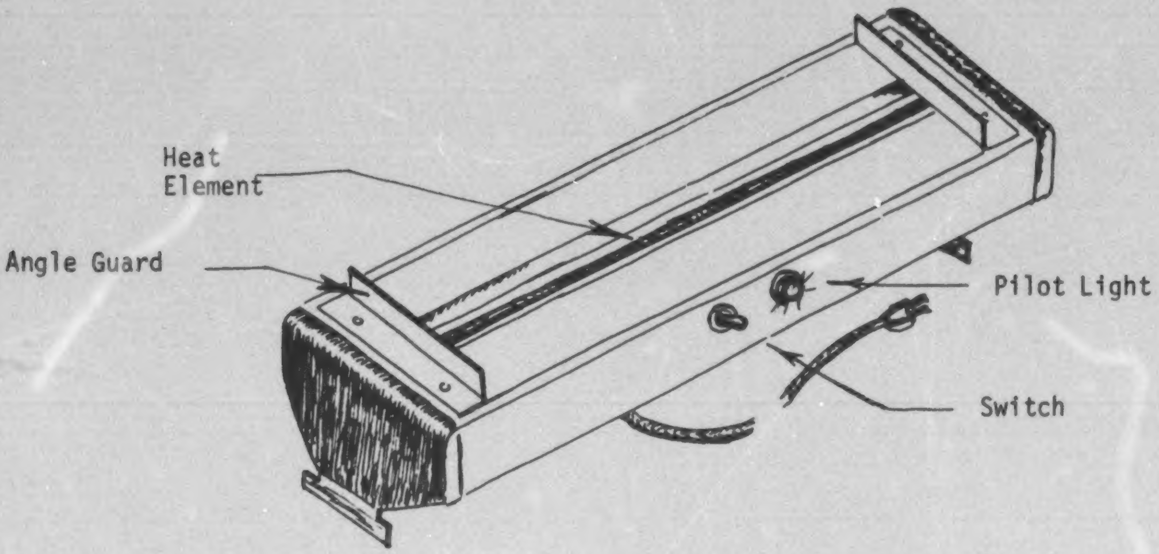


SQUARING SHEAR

USES: CUTTING SHEET METAL.

OPERATING AND SAFETY PROCEDURE:

1. CUT ONLY "SHEET METAL" ON THIS MACHINE.
2. CUT ONLY 16 GAUGE OR THINNER SHEET METAL.
3. NOTICE WHERE ORANGE BLADE GUARD IS AND KEEP FINGERS CLEAR OF THIS AREA.
4. BACK GAUGE CAN BE SET FOR A SERIES OF UNIFORM CUTS.
5. LINE UP CUT MARKS BY LOOKING DIRECTLY DOWNWARD AT CUTTING EDGE, BETWEEN BLADE AND GUARD.
6. THE BLADE WILL CUT FIRST ON THE RIGHT HAND SIDE OF YOUR MATERIAL.
7. DO NOT REACH BEHIND MACHINE TO CATCH MATERIAL AS YOU CUT IT.
8. BE EXTREMELY CAREFUL IF SOMEONE IS ASSISTING YOU. BEFORE TREADLE IS PUSHED, YOU MUST KNOW THAT THE BLADE IS CLEAR OF FINGERS.
9. OPERATE TREADLE WITH FOOT. BE SURE OTHER FOOT IS NOT DIRECTLY UNDER TREADLE.
10. REPLACE SAFETY CHAIN WHEN THROUGH WITH OPERATION.



STRIP HEATER

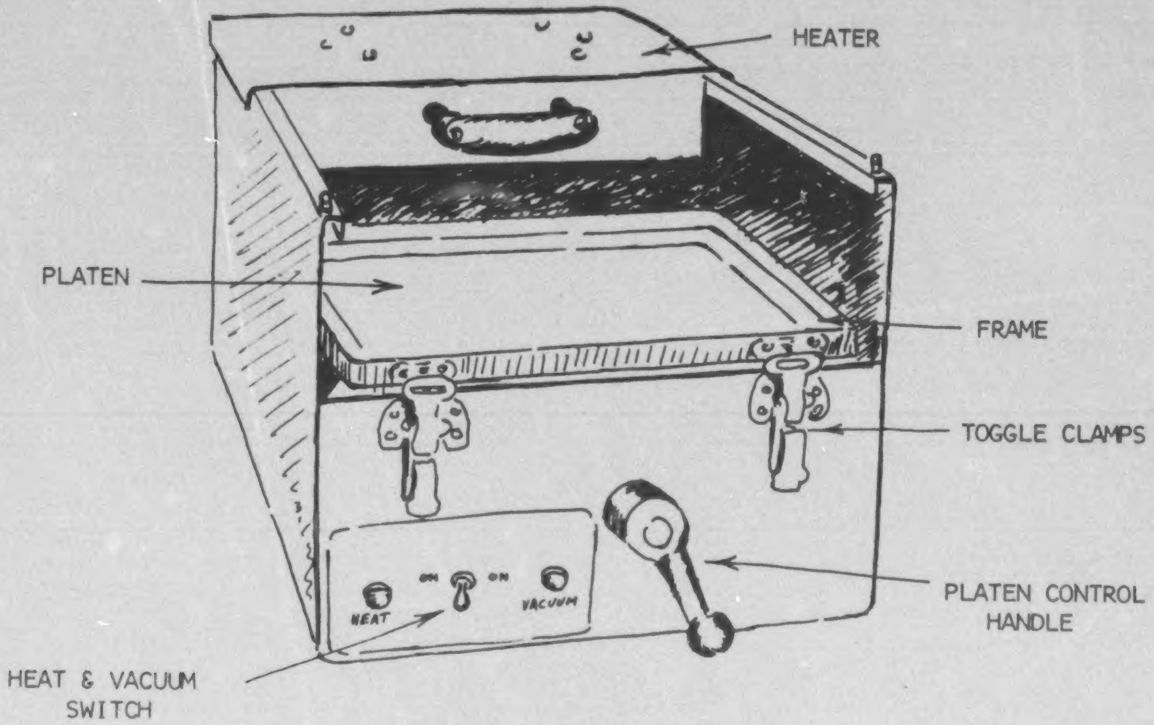
USES: TO BEND UP TO 1/4" PLASTIC.

SAFETY PROCEDURE:

1. DO NOT LEAVE MACHINE WHEN POWER IS ON.
2. WEAR SAFETY GLASSES OR GOGGLES.
3. TURN OFF SWITCH AND REPLACE GUARD BEFORE LEAVING MACHINE.
4. WHEN HANDLING PLASTIC THAT HAS BEEN HEATED, ALWAYS WEAR GLOVES.

OPERATING PROCEDURE:

1. REMOVE MASKING PAPER ALONG THE LINE TO BE HEATED.
2. PLACE THE PLASTIC WITH THE BENDING LINE DIRECTLY OVER HEATING ELEMENT.
3. PROPERLY HEAT PLASTIC. THE PLASTIC WILL SOFTEN AND SAG AS IT NEARS THE PROPER TEMPERATURE. WITH PLASTIC OVER 1/16" THICK IT MAY BE NECESSARY TO TURN AND WARM OTHER SIDE.
4. REMOVE PLASTIC AND BEND BY HAND ALONG HEATED LINE.
5. HOLD IN PROPER POSITION UNTIL COOL. IT MAY TAKE SEVERAL MINUTES.



VACUUM FORMER

USES: HEATING OF SHEETS OF PLASTIC TO CONFORM TO THE CONTOURS OF A MOLD.

SAFETY PROCEDURE:

1. Do not touch the heater element.
2. Wear safety glasses, goggles or faceshield.
3. Observe safety rules in your notebook.

OPERATING PROCEDURE:

1. Select plastic material to be formed. Either styrene or acetate the piece must be 10" wide by 12" long.
2. Select an object to be vacuum formed.
3. Place object in the center of the perforated platen. This is the 9" x 11" table with holes every 1 inch. The table should be all the way down.
4. Place plastic material in the frame and clamp it into place.
5. Slide heater element over the plastic.
6. A three-way switch (on, off, on) is located on the front of the machine. To turn heat on, flip the switch toward the red light. The red light should come on.
7. For styrene - the white material. Heat until material sags and is rubbery, about 1 or 2 minutes.

   For acetate - shiney, different colors, clear. Becomes tight like a drum, and levels off.

VACUUM FORMER (CON'T)

8. WHEN THE PLASTIC MATERIAL IS AT THE PROPER TEMPERATURE, CRANK THE FRONT HANDLE CLOCKWISE TO RAISE THE OBJECT ON THE TABLE TO THE EXTREME UPPER POSITION. HOLD THE HANDLE IN THAT POSITION.

9. IMMEDIATELY FLIP THE SWITCH TO YOUR RIGHT OR VACUUM POSITION. A VACUUM WILL BE DRAWN.

   THE YELLOW LIGHT WILL COME ON AND THE HEAT WILL GO OFF.

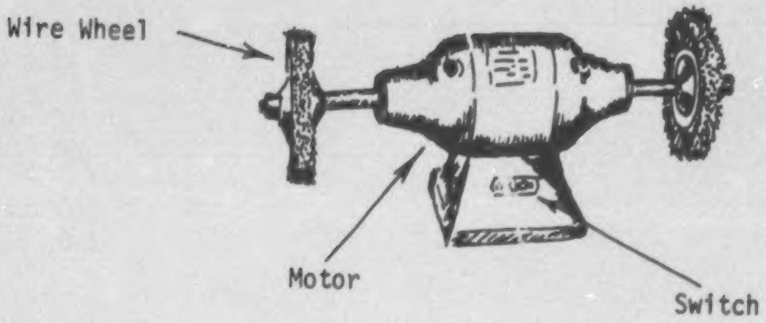
   NOTE: THE VACUUM REGULATOR ON THE FRONT OF THE MACHINE SHOULD NOT NEED TO BE ADJUSTED. FOR SPECIAL PROJECTS, SEE AN INSTRUCTOR.

10. SLIDE HEATER ELEMENT TO REAR.

11. LEAVE VACUUM ON UNTIL THE PLASTIC IS COOL ENOUGH TO TOUCH.

12. TURN VACUUM SWITCH TO MIDDLE OR "OFF" POSITION. DO NOT TURN TO HEAT POSITION.

13. LOWER TABLE CRANK, REMOVE PLASTIC FROM FRAME, PUT OBJECT AWAY AND STRAIGHTEN UP YOUR WORK AREA.



WIRE WHEEL

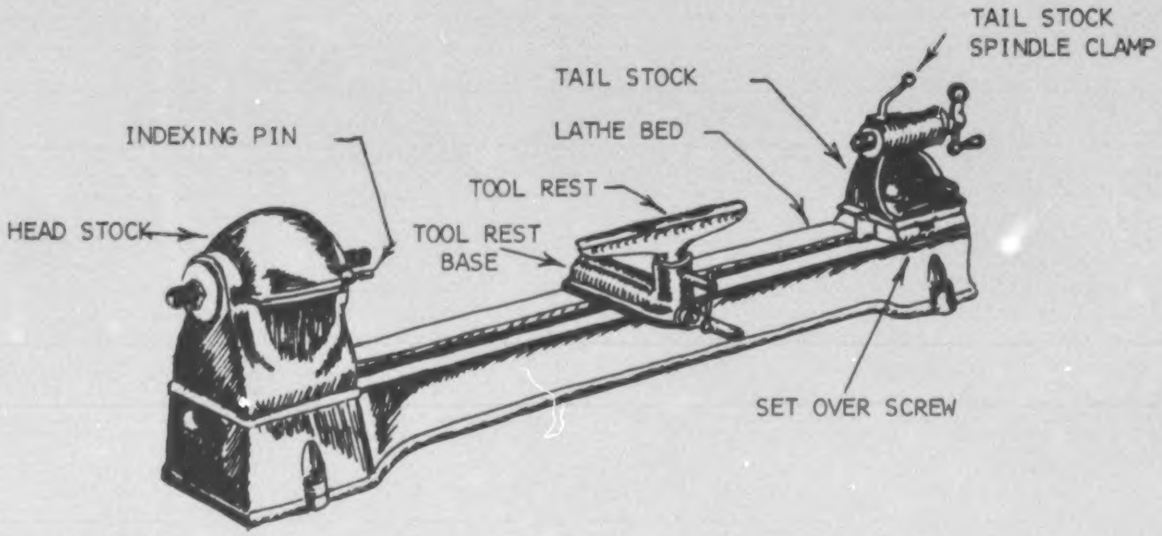
USES: To give metal a brushed finish. To clean rust, scale and paint from metal.

SAFETY PROCEDURE:

1. Eye shields must be in proper position and goggles must be worn.
2. Wear leather gloves.
3. Metal being brushed should be held firmly.
4. Always use the face of the wheel.
5. Stay at the wire wheel until it has stopped.

OPERATING PROCEDURES:

1. Hold the work firmly and move it across the face of the wheel to brush or clean.
2. Never let the top edge of the metal come into contact with the wire wheel, because the metal may be pulled from your hands.



LATHE

USES: THE LATHE IS USED TO ROTATE STOCK FOR SHAPING, SANDING OR POLISHING. IT IS ALSO USED AS A HOLDING JIG FOR FLUTING, REEDING AND DRILLING HOLES.

SAFETY PROCEDURES:

1. WHEN SELECTING STOCK FOR TURNING, AVOID LOOSE KNOTS, CHECKS, CROSS-GRAIN SPLINTERY STOCK, OR STOCK IMPROPERLY GLUED.
2. CHECK THE SPEED OF LATHE BEFORE MOUNTING STOCK.
3. AVOID DROPPING LIVE CENTER WHEN REMOVING FROM HEAD STOCK.
4. CHECK TO SEE THAT STOCK IS PROPERLY CENTERED.
5. CHECK TAIL STOCK TO SEE THAT IT IS LOCKED IN POSITION, SECURING WORK FIRMLY BETWEEN CENTERS.
6. ROTATE STOCK BY HAND TO DETERMINE CLEARANCE OF TOOL REST.
7. AVOID LOOSE CLOTHING AND DANGLING TIES.
8. IT IS REQUIRED THAT A FACE SHIELD BE WORN WHEN OPERATING A LATHE.
9. MAINTAIN TOOL REST AT PROPER HEIGHT AND DISTANCE FROM WORK.
10. ROUGH TURNING SHOULD BE DONE AT A SLOW SPEED.
11. AVOID HEAVY CUTS.
12. KEEP HANDS OFF OF STOCK WHICH IS REVOLVING.
13. ALWAYS HOLD TURNING CHISEL AT PROPER ANGLE WITH A FIRM GRIP.
14. PERIODICALLY CHECK THE DEAD CENTER FOR HEATING, LUBRICATION, AND ADJUSTMENT.
15. TOOLS ARE NOT TO BE LEFT ON BED OF LATHE.
16. TOOLS SHOULD BE KEPT SHARP AT ALL TIMES.
17. TOOL REST SHOULD BE REMOVED BEFORE SANDING.

OPERATING PROCEDURE:

SPINDLE TURNING:

1. CUT STOCK TO SIZE WITH AN ALLOWANCE OF ONE INCH FOR WASTE IN LENGTH AND 1/4" FOR WASTE IN DIAMETER. SQUARE THE ENDS AND FIND THE CENTER OF EACH END BY USING INTERSECTING DIAGONAL LINES.
2. USING A BACKSAW, CUT ONE END ON LINES TO A DEPTH OF 1/8". CENTER PUNCH OTHER END AT CENTER.
3. REMOVE THE LIVE SPUR CENTER FROM THE LATHE WITH A DRIVE-OUT ROD. USING A WOODEN MALLET, DRIVE THE LIVE SPUR CENTER INTO THE WOOD, SO THAT THE SPURS ENTER THE KERF MADE BY THE SAW.
4. REPLACE THE STOCK AND LIVE CENTER INTO THE SPINDLE OF THE HEAD STOCK.
5. SET AND TIGHTEN TAILSTOCK ABOUT 1/2" FROM PIECE TO BE TURNED. HOLDING THE WOOD BETWEEN THE CENTERS, TURN THE BALL-CRANK HANDLE ON THE TAILSTOCK SPINDLE SO THAT THE POINT OF THE CENTER ENTERS THE WOOD. IF USING A CUP CENTER, LUBRICATE WITH A DROP OF OIL.
6. TURN THE LATHE BY HAND AND SEE THAT THE WOOD TURNS EASILY. THEN TIGHTEN THE TAILSTOCK SLEEVE CLAMP TO HOLD THE SPINDLE IN THIS POSITION.
7. CAUTION: NEVER MAKE TOOLREST ADJUSTMENTS WHILE THE MACHINE IS RUNNING. ADJUST TOOLREST SO THE TOOL IS CUTTING 1/8" ABOVE CENTER.
8. PIECES OF STOCK 2" SQUARE SHOULD HAVE THE CORNERS REMOVED BEFORE INSERTING PIECE IN THE LATHE.
9. ASSUME A NATURAL POSITION WITH FEET SLIGHTLY SPREAD AND ONE FOOT A LITTLE BEHIND THE OTHER, AND WITH THE WEIGHT EVENLY DISTRIBUTED.
10. HOLD CUTTING TOOL FIRMLY. LOOK AT LOOP FILMS FOR PROPER USE OF CUTTING TOOLS.
11. GRASP THE HANDLE WELL OUT TOWARD THE END, KEEP THE ELBOW CLOSE TO YOUR SIDE, WITH THE OTHER HAND HOLD THE BLADE AND REST YOUR FINGERS ON THE BACK SIDE OF THE TOOL REST.

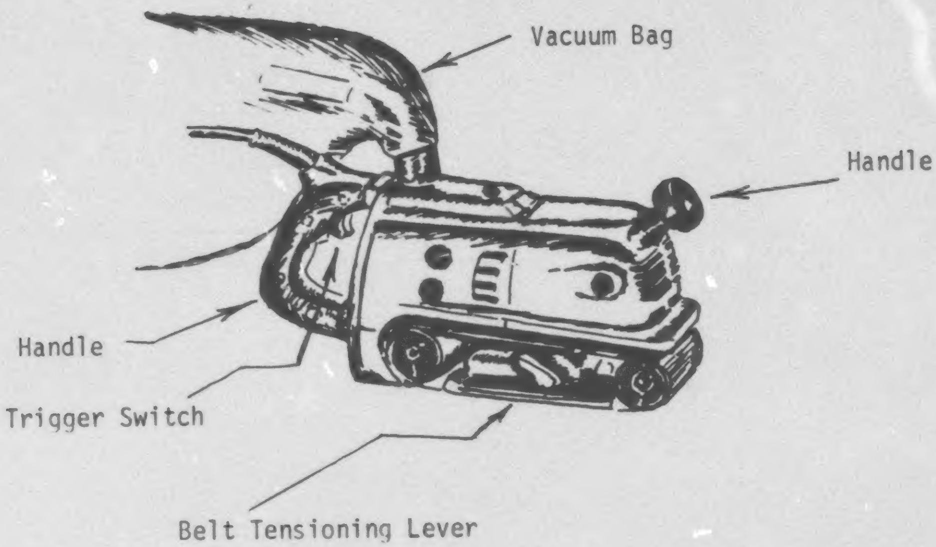
FACE-PLATE TURNING:

1. IN FACE PLATE TURNING, THE STOCK IS MOUNTED ON A FLAT METAL PLATE WHICH IS ATTACHED TO THE SPINDLE OF THE HEAD STOCK.
2. BAND SAW A DISK 1/8" LARGER IN DIAMETER THAN THE FINISHED DIMENSIONS.
3. SELECT A FACE-PLATE SMALLER THAN THE DISK TO BE TURNED.
4. IF SCREW HOLES ARE OBJECTIONABLE IN THE BOTTOM OF THE FINISHED TURNING OR IF THERE IS A POSSIBILITY OF THE TURNING TOOLS STRIKING THE SCREWS, A BLOCK OF WOOD ABOUT THE SIZE OF FACE PLATE SHOULD BE GLUED TO THE BASE OF THE WORK. IN GLUING, A PIECE OF BUTCHER PAPER SHOULD BE PLACED BETWEEN THE GLUED SURFACES IN ORDER TO SIMPLIFY SEPARATION. PAPER DRYING TOWEL IS NOT SUITABLE.
5. SCREW THE FACE PLATE FIRMLY TO THE BASE OF THE STOCK TO BE TURNED.
6. REMOVE THE LIVE CENTER FROM THE LATHE AND SCREW THE FACE PLATE TO THE SPINDLE.

7. ADJUST THE TOOL REST SO THE TOOL IS ABOVE CUTTING CENTER AND 1/8" AWAY FROM THE STOCK.
8. USE SLOW SPEED UNTIL THE STOCK IS ROUND.
9. REFER TO FILM FOR PROPER USE OF CUTTING TOOLS.
10. AS WASTE STOCK IS REMOVED FROM THE TURNING, THE TOOL REST SHOULD BE ADVANCED.

SANDING

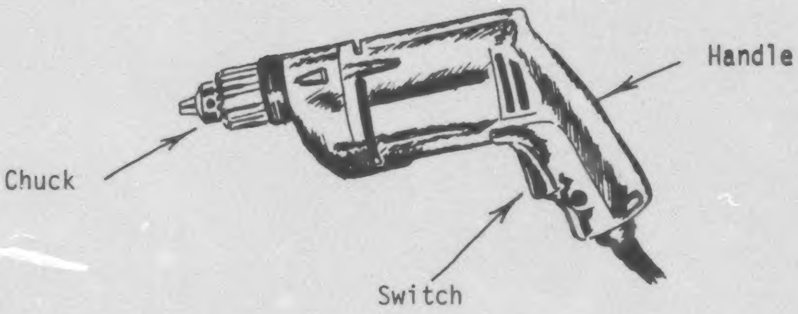
1. REMOVE THE TOOL REST FOR SANDING.
2. ON SPINDLE SANDING, HOLD SMALL PAD OF SANDPAPER ON UNDERSIDE OF STOCK.
3. FACE-PLATE SANDING, HOLD SANDPAPER IN ONE HAND AND SAND ON DOWNWARD MOTION. EXTERNAL FACE-PLATE SANDING, SAND AS IN STEP 2.
4. DO NOT EXCEED 1000 RPM WITHOUT SPECIAL PERMISSION.


Vacuum Bag
Handle
Handle
Trigger Switch
Belt Tensioning Lever

BELT SANDER

OPERATING AND SAFETY PROCEDURE:

1. LAY THE MACHINE ON ITS SIDE WHEN CONNECTING ELECTRIC CORD.
2. BE SURE BELT IS PROPERLY CENTERED ON ROLLERS.
3. LET THE WEIGHT OF THE SANDER DO THE WORK. NO EXCESSIVE PRESSURE ON THE MACHINE.
4. MOVE THE MACHINE ACROSS THE WORK AT ALL TIMES WHILE SANDING.
5. BE CAREFUL THAT YOU DO NOT SAND THE ELECTRIC CORD.
6. START THE MACHINE WHILE OFF THE SURFACE.
7. LIFT THE MACHINE OFF THE SURFACE BEFORE STOPPING.
8. SANDING SHOULD BE DONE AT AN ANGLE ACROSS THE WORK. FINISH UP BY GETTING ALL MARKS PARALLEL TO THE GRAIN.



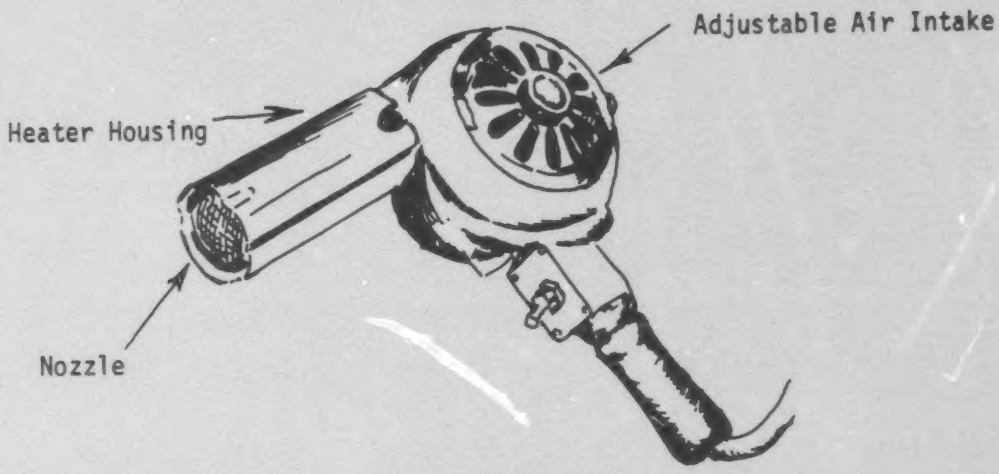
ELECTRIC DRILLS

OPERATING AND SAFETY PROCEDURE:

1. TIGHTEN CHUCK SECURELY AND REMOVE CHUCK KEY.
2. DO NOT USE OVERSIZED BITS. THE CAPACITY OF THE DRILL IS DESIGNATED BY THE SIZE OF CHUCK. CONSULT INSTRUCTOR FOR OTHER SIZE BITS.
3. DO NOT USE AN AUGER (SCREW POINT) BIT.
4. DO NOT OVERLOAD DRILL SO THAT IT SLOWS DOWN TO THE POINT OF OVERHEATING AND STALLING.

OPERATION OF VARIABLE SPEED:

1. THE SLOWER SPEEDS ARE USED FOR STARTING HOLES WITHOUT CENTER PUNCHING, FOR MIXING PAINTS AND DRILLING CERAMICS.
2. THE MEDIUM SPEEDS ARE USED FOR INCREASED POWER IN DRILLING FERROUS METALS, PLASTICS AND LAMINATES.
3. MAXIMUM SPEED AND POWER IS USED IN DRILLING WOOD AND DRIVING ACCESSORIES. THIS SPEED SHOULD ALSO BE USED FOR DRILLING NON-FERROUS METALS.



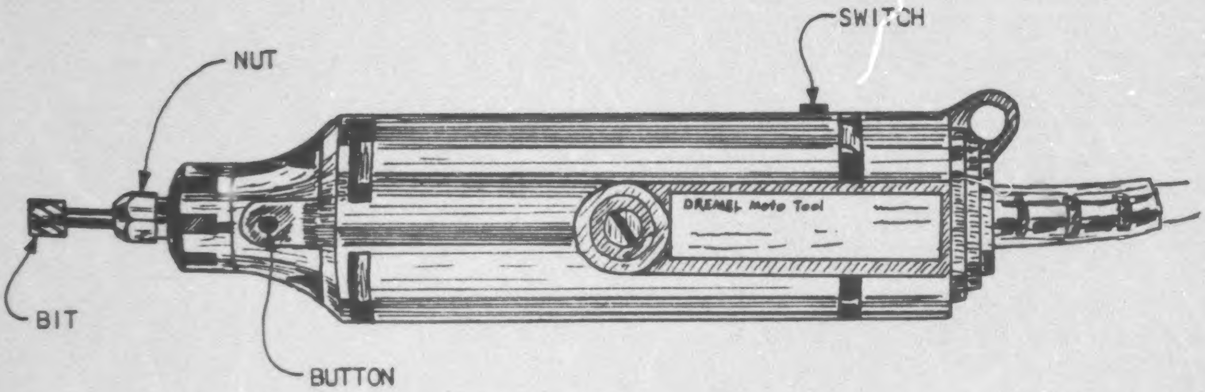
HEAT GUN

USES:

1. SOFTEN OR SET PLASTICS.
2. DRY PAINT OR GLUE.
3. PREHEAT METALS.
4. HEAT SEAL - HEAT MOLD.
5. SHRINK OR EXPAND MATERIALS.
6. THAW FORZEN PIPES, RADIATORS.
7. REMOVE MOISTURE AND CONDENSATION.

OPERATING AND SAFETY PROCEDURES:

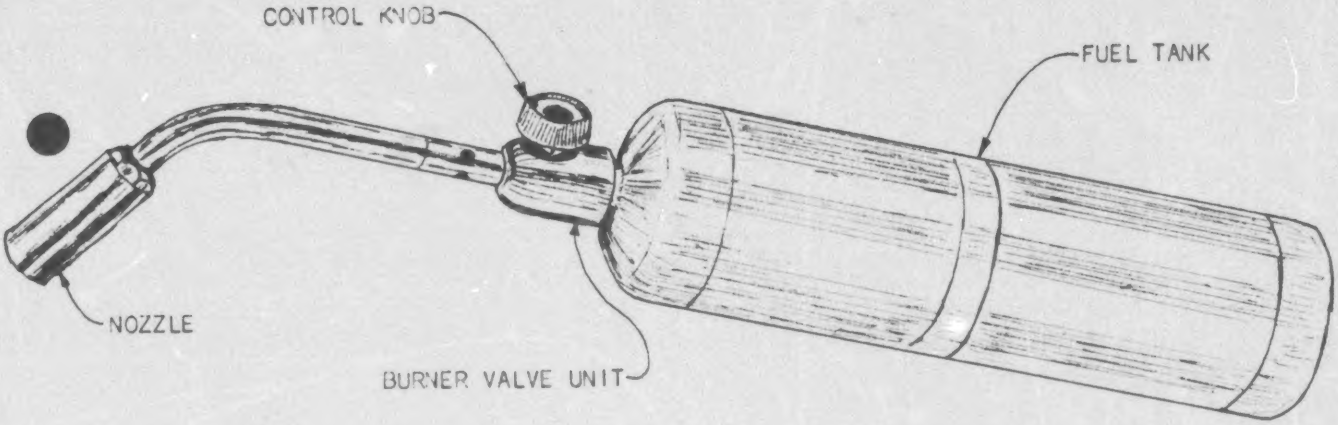
1. THIS GUN IS FRAGILE. DO NOT BUMP OR USE RECKLESSLY.
2. KNOW WHAT YOU ARE POINTING THE GUN AT BEFORE YOU START HEATING THE OBJECT.
3. 500° IS THE MAXIMUM TEMPERATURE AND WILL CHAR PAPER. BE CAREFUL OF FIRE.



MOTO TOOLS

OPERATING AND SAFETY PROCEDURE:

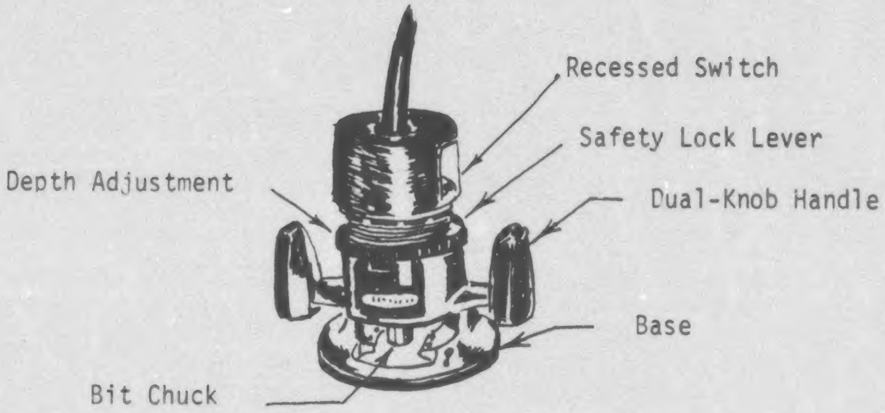
1. PUSH BUTTON AND ROTATE SHAFT UNTIL BUTTON GOES DOWN.
2. REMOVE NUT AND COLLET.
3. INSERT CARVING BIT INTO COLLET CHUCK.
4. TIGHTEN NUT AND COLLET ON MACHINE.
5. PLUG MACHINE IN AND TURN ON SWITCH.
6. HOLD CLOSE TO THE CARVING BIT END FOR BETTER CONTROL.
7. ALWAYS UNPLUG MACHINE WHEN CHANGING CARVING BITS.
8. HOLD WORKPIECE FIRMLY.
9. DO NOT POINT CUTTING TOOL AT OTHER PEOPLE. IT OPERATES AT 12000-18000 RPM AND CUTS RAPIDLY INTO PLASTIC OR HUMAN FLESH.
10. DO NOT PUSH BUTTON WHILE MACHINE IS RUNNING.



PROPANE TORCH

OPERATING & SAFETY PROCEDURE:

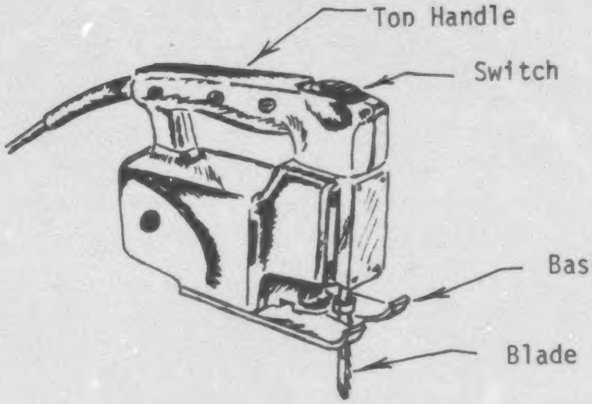
1. CAREFULLY READ OTHER INSTRUCTIONS AND CAUTIONS PRINTED ON FUEL TANK LABEL.
2. BE SURE VALVE IS FULLY CLOSED BY TURNING "ON OFF" CONTROL KNOB CLOCKWISE.
3. SCREW BURNER AND VALVE ONTO TANK CLOCKWISE, FINGERTIGHT.
4. MAKE SURE BURNER VALVE UNIT IS SCREWED TIGHT ON TO TANK.
5. PLACE CUP OF SPARK LIGHTER AGAINST END OF BURNER. INCLINE ABOUT 30 DEGREES.
6. OPEN VALVE ONE TURN AND MAKE SPARKS WITH STRIKER.
7. IF THERE IS A FLAME FROM ANY PLACE OTHER THAN FROM THE NOZZLE, TURN OFF IMMEDIATELY.
8. ADJUST TO DESIRED FLAME.
9. ALLOW TORCH TO THOROUGHLY WARM UP BEFORE USING IN UPSIDE DOWN POSITION.
10. DO NOT POINT FLAME AT ANYONE.
11. OBSERVE ALL GENERAL SAFETY RULES IN YOUR NOTEBOOK.



ROUTER

OPERATING AND SAFETY PROCEDURE:

1. DISCONNECT ELECTRICITY WHEN CHANGING BITS OR MAKING ADJUSTMENT.
2. WEAR SAFETY GLASSES OR GOGGLES.
3. INSERT BIT INTO CHUCK AT LEAST 1/2 INCH, AND TIGHTEN.
4. DETERMINE DEPTH OF CUT YOU WANT.
5. TURNING DEPTH ADJUSTMENT ON MOTOR, ADJUST SO BOTTOM OF BIT JUST TOUCHES SURFACE OF PROJECT.
6. LOCK BASE TO MOTOR USING LOCKING HANDLE.
7. MOVE DEPTH ADJUSTMENT RING UP TO DESIRED DEPTH.
8. LOOSEN LOCKING HANDLE AND MOVE SUB-BASE UP TO DEPTH ADJUSTMENT RING AND LOCK BASE.
9. MAKE CERTAIN THAT PROJECT IS CLAMPED TO BENCH.
10. MAKE TRIAL CUT ON SCRAP PIECE OF LUMBER.
11. KEEP PRESSURE EVEN AND MOVE LEFT TO RIGHT.
12. MAKE SURE BIT IS CLOSE TO WOOD, BUT NOT TOUCHING WHEN POWER IS TURNED OFF.
13. WHEN FINISHED, LIFT BIT ABOVE WORK 1/2" AND TURN POWER OFF. WAIT UNTIL ROUTER STOPS.
14. DISCONNECT POWER FROM POWER SOURCE AND REMOVE BIT.



SABER SAW

USES: STRAIGHT, CURVED, BEVEL AND INTERNAL CUTS ON WOOD, METAL, PLASTIC AND FIBERGLASS.

SAFETY PROCEDURE:

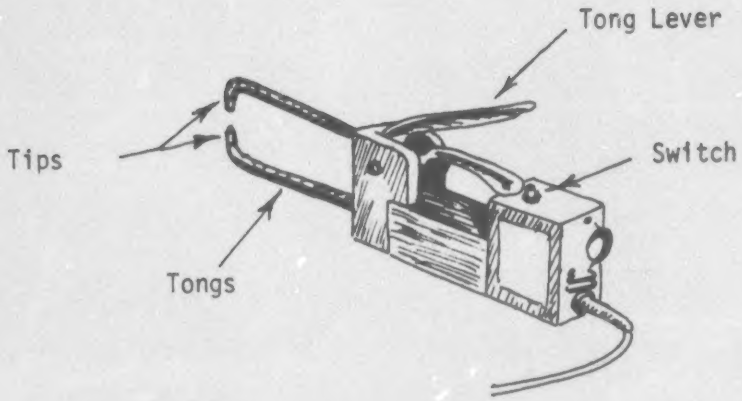
1. DISCONNECT THE PLUG BEFORE YOU MAKE ADJUSTMENTS OR CHANGE THE BLADE.
2. HOLD OR CLAMP THE MATERIAL TO BE CUT SO THAT IT WILL NOT VIBRATE.
3. ALWAYS HOLD THE TOOL FIRMLY.
4. ALLOW THE BLADE TO COME TO FULL SPEED BEFORE STARTING TO CUT.
5. PROTECT YOUR CLOTHING.
6. CONCENTRATE ON WHAT YOU ARE DOING.
7. WEAR GOGGLES OR A FACE SHIELD.

OPERATION PROCEDURE:

1. SEE THAT THE PROPER BLADE FOR YOUR WORK IS INSTALLED.
2. SECURE THE MATERIAL TO BE CUT.
3. START MOTOR AND ALLOW IT TO COME TO FULL SPEED.
4. HOLD THE SAW FIRMLY ON THE WORK AND MOVE IT ALONG SLOWLY. DO NOT FORCE IT.
5. FOR INSIDE CUTS, DRILL A HOLE FOR STARTING.
6. WHEN THROUGH CUTTING, TURN OFF SWITCH. DO NOT SET SAW DOWN UNTIL MOTOR STOPS.
7. THE BOSCH SABER SAW HAS A BLADE SWING ADJUSTMENT. SETTINGS ARE:

   0 OR 1 FOR METALS OR SMOOTH CUTS OF WOOD

   11 OR 111 FOR FAST CUTTING ON WOOD OR PLASTIC



SPOT WELDER

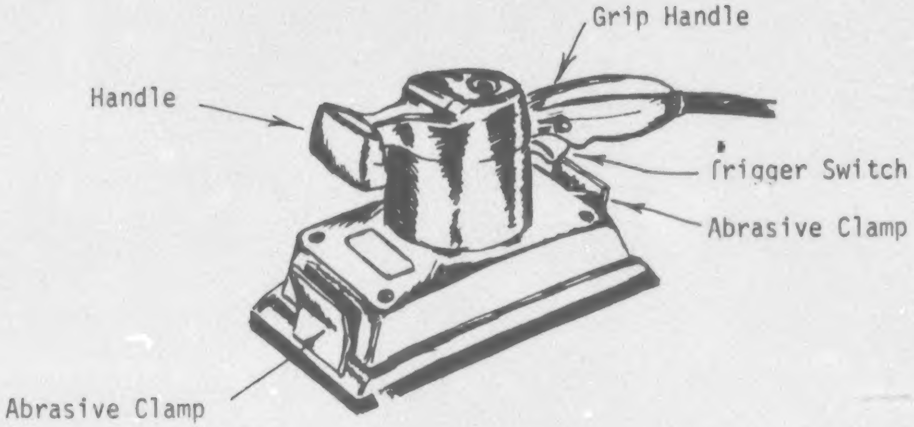
USES: FASTENING PIECES OF METAL TOGETHER.

SAFETY PROCEDURE:

1. DO NOT TOUCH THE TIPS, TONGS, OR WELDED MATERIAL, AS THEY BECOME VERY HOT.
2. WHEN SPOT WELDING GALVANIZED STEEL, YOU SHOULD WEAR A LONG-SLEEVED SHIRT AND A FACE SHIELD.
3. DO NOT WELD WITH WET HANDS OR IN A DAMP AREA.
4. WEAR SAFETY GLASSES OR GOGGLES.

OPERATING PROCEDURES:

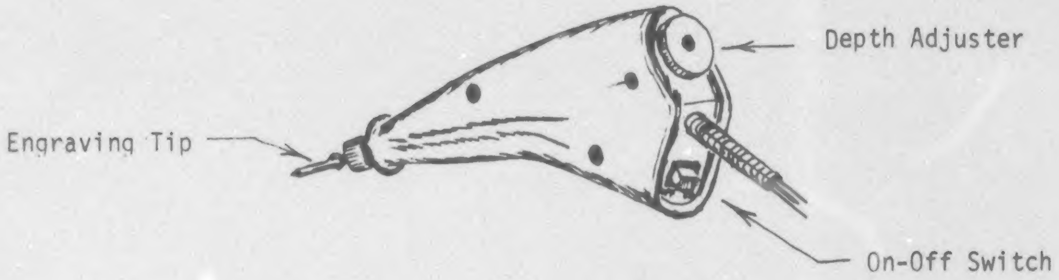
1. BE SURE THE PIECES OF METAL ARE CLEAN.
2. PLUG IN THE SPOT WELDER.
3. PLACE METAL TO BE WELDED BETWEEN THE TIPS AND PUSH TONG LEVER DOWN.
4. PUSH SWITCH TO ON TO MAKE WELD. RELEASE SWITCH BEFORE RELIEVING TONG PRESSURE.


Grip Handle
Handle
Trigger Switch
Abrasive Clamp
Abrasive Clamp

VIBRATOR SANDER

OPERATING AND SAFETY PROCEDURE:

1. LET THE WEIGHT OF THE SANDER DO THE WORK. NO EXCESSIVE PRESSURE ON THE MACHINE.
2. SANDING ON NARROW EDGES WILL TEAR THE ABRASIVE PAPER.
3. KEEP SANDER IN FLAT POSITION. DO NOT TILT ON ONE END OR THE OTHER.
4. START SANDER WHILE OFF THE WORK, THEN PROCEED TO SAND.
5. LIFT SANDER OFF THE WORK BEFORE STOPPING MOTOR.
6. CLEAN MACHINE BEFORE STORING.

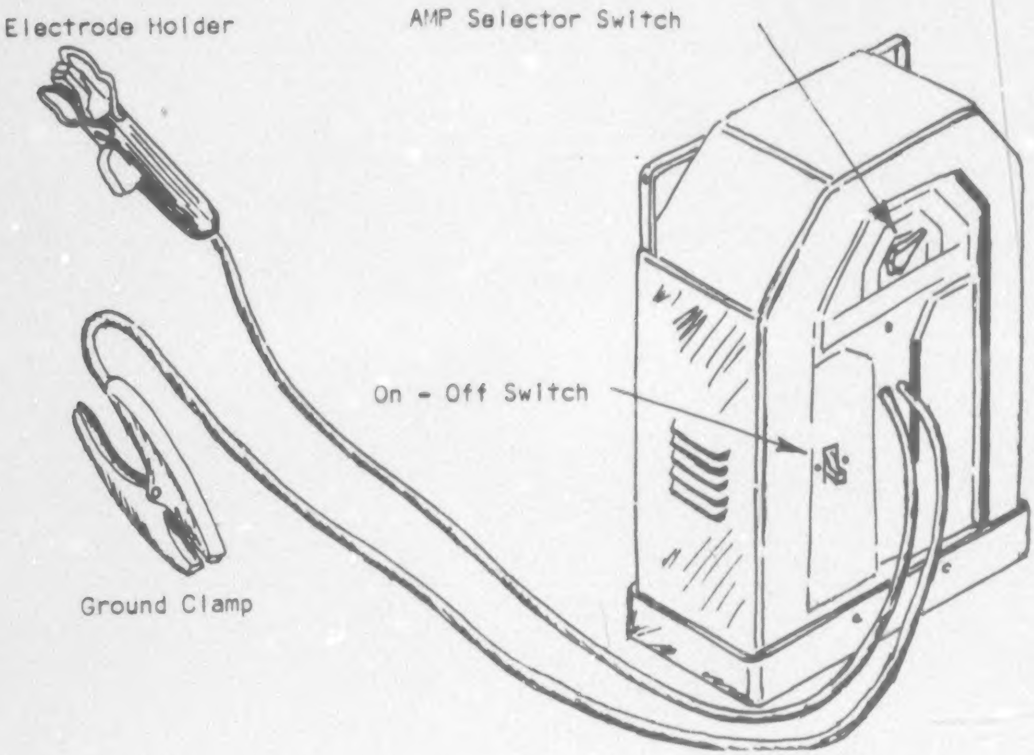


VIBRO TOOL ENGRAVER

USES: ENGRAVING ON METAL, PLASTIC, CERAMICS, WOOD.

OPERATING AND SAFETY PROCEDURE:

1. CHECK ELECTRIC CORD FOR EXPOSED OR BROKEN WIRE. MAKE SURE YOUR HANDS ARE DRY AND THAT YOU ARE NOT STANDING IN WATER.
2. PLUG IN TO 110 V OUTLET.
3. TURN ON SWITCH.
4. WHEN MARKING ON METAL OR PLASTIC, THE ENGRAVER IS HELD AT A SLIGHT ANGLE, JUST AS YOU WOULD HOLD A PENCIL.
5. WHEN MARKING ON CERAMICS OR WOOD, THE ENGRAVER IS HELD SO THAT THE POINT IS PERPENDICULAR TO THE MATERIAL ON WHICH YOU ARE WORKING.
6. ROTATE STROKE ADJUSTER UNTIL THE DESIRED DEPTH OF CUT HAS BEEN REACHED. NOTE: USE A SMALL PIECE OF MATERIAL TO DEVELOP A "FEEL" FOR THE ENGRAVER AND TO SET THE DESIRED DEPTH OF CUT FOR THE MATERIAL TO BE USED.
7. PRESS DOWN SLIGHTLY AND MOVE THE HAND SLOWLY, ALLOWING THE TOOL ITSELF TO PRODUCE A SMOOTH, EVEN LINE. SUPPORT YOUR ARM ON THE TABLE ON WHICH YOU ARE WORKING.



ARC WELDER

USES: TO FUSE METAL TOGETHER BY HEATING WITH AN ELECTRIC ARC.

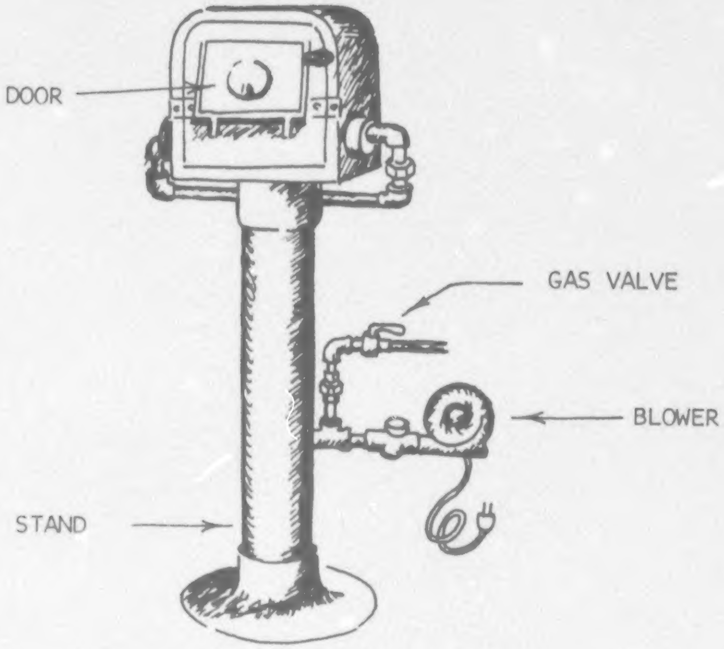
SAFETY PROCEDURE:

1. BEFORE ATTEMPTING TO MAKE PRIMARY OR SECONDARY CONNECTIONS, CHANGE PARTS OR MAKE REPAIRS, BE SURE THE WELDING MACHINE IS COMPLETELY DISCONNECTED FROM THE MAIN POWER LINE.
2. WEAR PROPER CLOTHING TO PROTECT FROM SPLATTER AS WELL AS RADIATION.
3. WEAR WELDING GLOVES WHEN OPERATING ELECTRODE HOLDER.
4. EYE PROTECTION:
    (A) FILTER GLASS FOR ARC WELDING SHOULD BE #10 TO #12 SHADE.
    (B) DON'T, UNDER ANY CIRCUMSTANCES, LOOK AT AN ELECTRIC ARC WITH THE UNPROTECTED EYE.
    (C) DON'T USE CRACKED, ILL FITTING OR DEFECTIVE FILTER PLATES.
    (D) DON'T USE FILTER PLATES WITHOUT A PROTECTING COVER GLASS.

    RAYS WILL BURN THE EYES OR SKIN IN MUCH THE SAME MANNER AS A SUNBURN.
5. WELD ONLY IN AREAS WITH ADEQUATE VENTILATION.
6. WEAR GOGGLES WHEN CHIPPING OR GRINDING.
7. KEEP HANDS, CLOTHING AND WORK AREA DRY AT ALL TIMES.
8. BE SURE POWER SWITCH IS OFF BEFORE LAYING ELECTRODE HOLDER ON TABLE TO WHICH GROUND CLAMP IS ATTACHED.
9. PROTECTIVE CURTAIN SHOULD BE CLOSED WHEN WELDING IN BOOTH.
10. BE SURE THAT OBSERVERS HAVE PROPER EYE PROTECTION.

OPERATING PROCEDURE:

1. SELECT PROPER AMPERAGE ON MACHINE FOR THE THICKNESS OF MATERIAL TO BE WELDED. USE VERNIER CURRENT ADJUSTMENT CONTROL.
2. CONNECT WORK CLAMP TO METAL WORK TABLE OR TO MATERIAL TO BE WELDED.
3. SELECT PROPER ELECTRODE AND INSERT IT IN ELECTRODE HOLDER.
4. PLACE THE PROPER SWITCH IN THE "ON" POSITION.
5. POSITION HELMET AND PROPER PROTECTIVE CLOTHING.
6. STRIKE THE ARC AS DESCRIBED IN REFERENCE MATERIAL - GENERAL METALS PAGES 263-264.
7. AFTER THE WELDING JOB IS COMPLETED, BREAK THE ARC AND PLACE THE POWER SWITCH IN THE "OFF" POSITION.



FORGE

USES: A FORGE IS USED TO HEAT THE METAL TO BE SHAPED, AND FOR HEAT TREATMENT OF METALS.

SAFETY PROCEDURE:

1. DO NOT LOOK INTO THE OPENING OF THE FURNACE WHEN LIGHTING.
2. WEAR GOGGLES WHEN HAMMERING HOT METAL.
3. WEAR GLOVES WHEN NECESSARY.
4. USE TONGS WHEN HANDLING HOT METAL TOO SHORT TO HOLD BY HAND.
5. WHEN WORKING WITH HOT METAL, BE CAREFUL NOT TO BURN YOURSELF OR ANOTHER PERSON.
6. MARK ALL HOT METAL.

OPERATING PROCEDURE:

1. TO LIGHT A GAS FURNACE, PLACE A LIGHTED PIECE OF PAPER IN THE FIRE BOX CLOSE TO A BURNER.
2. TURN ON A SMALL AMOUNT OF AIR AND THEN TURN ON THE FUEL UNTIL THE FURNACE LIGHTS UP.
3. AS THE FURNACE HEATS UP, TURN ON MORE FUEL AND AIR UNTIL THE FLAME IS BLUE. SAMMY SAFETY SAYS: "DO NOT LOOK INTO THE OPENING OF THE FURNACE AS THE FUEL IS TURNED ON."
4. TOO MUCH AIR CAUSES THE FORMATION OF A HEAVY SCALE ON THE METAL BEING FORGED, CALLED OXIDIZING.
5. INSERT THE METAL IN THE FORGE, AND HEAT THE METAL UNTIL BRIGHT RED HEAT.
6. HOLD THE METAL FIRMLY WITH THE TONGS TO DO THE VARIOUS FORGING OPERATIONS AND ALWAYS KEEP THE METAL AT FORGING TEMPERATURE.

7. TO DO TAPERING SUCH AS IN MAKING A COLD CHISEL, HOLD THE HEATED END AT A SLIGHT ANGLE ON THE FACE OF THE ANVIL AND STRIKE IT WITH A BLACKSMITH'S HAMMER. ALWAYS WORK THE METAL ON BOTH SIDES.

8. DRAWING OUT IS DONE TO LENGTHEN A PIECE OF STOCK OR TO REDUCE ITS CROSS-SECTIONAL AREA, BY CHANGING ITS SHAPE, FOR EXAMPLE, FROM SQUARE TO ROUND AND THEN BACK TO SQUARE, AS THE DRAWING OUT IS DONE.

9. BENDING HOT METAL OVER AN ANVIL, CLAMP IN A BENCH VISE AND STRIKE THE METAL NEAR THE BEND LINE WITH A HAMMER. USE A BENDING JIG.

10. TWISTING METAL HELD IN A VERTICAL POSITION, USE A VISE AND A WRENCH.

11. FLARING - SPREADING OUT THE END OF A PIECE OF METAL ON THE ANVIL WITH A BLACKSMITH'S HAMMER.

12. WHEN YOU ARE THROUGH USING THE GAS FURNACE, TURN OFF THE GAS, WAIT TWO OR THREE MINUTES, AND THEN TURN OFF THE AIR.

SPECIAL OPERATIONS:

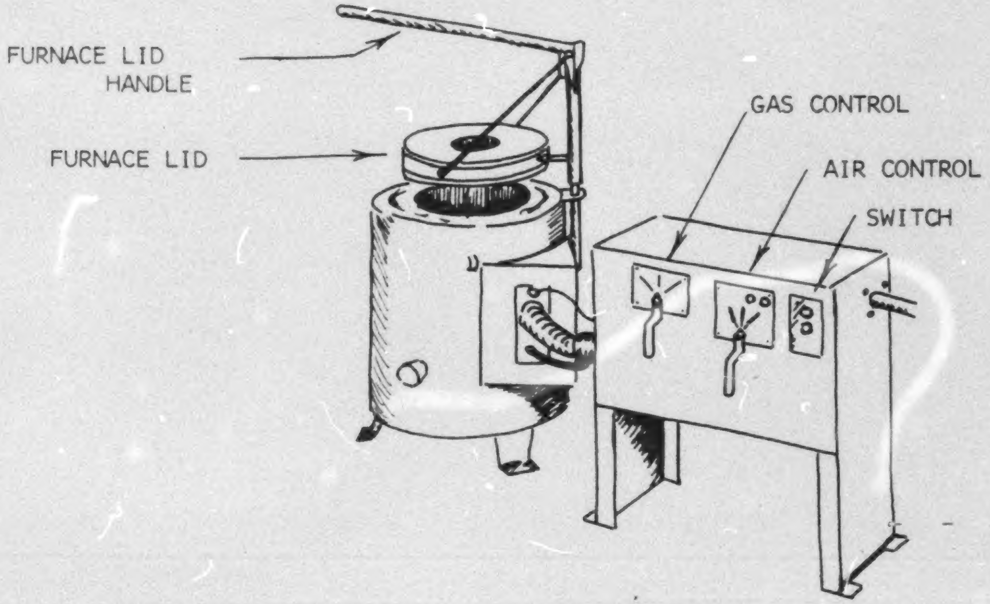
(A) HEAT TREATMENT OF STEELS:

1. HARDENING - IS A PROCESS OF HEATING STEEL TO A CERTAIN TEMPERATURE AND THEN QUENCHING (COOLING) IT IN A SUITABLE MEDIUM SUCH AS WATER, OIL, OR BRINE, DEPENDING UPON THE TYPE OF STEEL BEING HARDENED.

2. TEMPERING - IS A PROCESS WHICH IS USED TO REMOVE A CERTAIN DEGREE OF HARDNESS AND BRITTLENESS OF STEEL AND INCREASE ITS TOUGHNESS. THE TEMPER IS GAUGED BY THE COLORS FORMED ON THE SURFACE AS THE HEAT INCREASES.

DEGREES FAHRENHEIT	COLORS FOR TEMPERING
440	YELLOW
460	STRAW-YELLOW
470	STRAW
500	BROWN
520	BROWN-PURPLE
540	PURPLE
570	BLUE

3. ANNEALING - IS THE PROCESS OF SOFTENING STEEL TO RELIEVE STRESSES AND HARDNESS BY HEATING THE METAL SLOWLY AND COOLING THE METAL SLOWLY IN HOT SAND OR THE FURNACE.



FOUNDRY

USES: A FOUNDRY IS A SHOP IN WHICH CASTINGS ARE MADE BY POURING MOLTEN METAL INTO SAND MOLDS.

SAFETY PROCEDURE:

1. DO NOT GET SAND TOO WET.
2. DRESS PROPERLY. WEAR A PAIR OF CLEAR GOGGLES, AND A FACE SHIELD, LEGGINGS AND ASBESTOS GLOVES.
3. NEVER STAND OR LOOK OVER THE MOLD DURING POURING.
4. USE TONGS TO PICK UP HOT METAL CASTINGS.
5. USE TONGS TO ADD COLD METAL TO FURNACE.
6. DO NOT LOOK OVER MOLD AS THE MOLTEN METAL COOLS.
7. MARK HOT METALS.

OPERATING PROCEDURE:

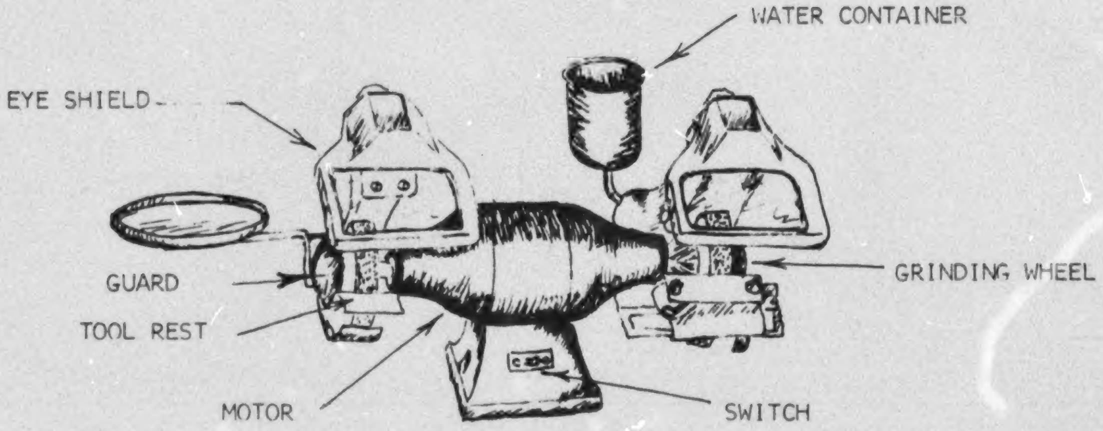
1. PLACE THE PATTERN, WITH THE DRAFT OR TAPERED SIDE UP, ON A MOLDING BOARD.
2. PLACE THE DRAG OVER THE BOARD.
3. RIDDLE SAND OVER PATTERN.
4. PACK THE SAND AROUND THE PATTERN WITH YOUR FINGERS.
5. SHOVEL SAND OVER PATTERN AND PACK FIRMLY WITH A RAMMER.
6. STRIKE OFF EXCESS SAND AND TURN OVER DRAG.
7. PLACE THE COPE IN POSITION, INSERT SPRUE AND RISER PIN, THEN SPRINKLE THE SURFACE WITH PARTING SAND.
8. REPEAT STEPS 1 - 6.
9. REMOVE SPRUE AND VISER PINS.

FOUNDRY (CON'T)

10. LIFT OFF THE COPE AND CUT GATES OR GROOVES FROM SPRUE AND RISER PINS TO THE PATTERN IMPRESSION.
11. BLOW OUT ANY LOOSE SAND AND REPLACE THE COPE ON THE DRAG.
12. HEAT METAL AND SLOWLY POUR THE HOT METAL INTO THE SPRUE HOLE UNTIL IT IS FULL. CHECK WITH TEACHER.

FOUNDRY GUIDE

1. FILL OUT PLAN SHEET COMPLETELY.
2. ALL FOUNDRY PLAQUES ARE TO BE MOUNTED.
3. VIEW THE FOUNDRY FILM. LOOK UP REFERENCES IN BOOKS.
4. CUT SUFFICIENT ALUMINUM TO POUR THE PROJECT.
5. BE SURE FURNACE IS STARTED AND CRUCIBLE IS STOCKED.
6. DO NOT OVERFILL THE CRUCIBLE. KEEP MELTED ALUMINUM AT LEAST 2" FROM THE TOP.
7. REPLACE PARTING COMPOUND ON SHELF WHEN THROUGH DUSTING PROJECT.
8. KEEP FOUNDRY SAND IN THE BOX, NOT ON THE FLOOR.
9. BE SURE SAND IS MIXED THOROUGHLY - DO DRY SPOTS.
10. THE PATTERN SHOULD BE AT LEAST 1/2" FROM THE EDGE OF THE FLASK.
11. THE COPE AND DRAG MUST FIT TOGETHER PROPERLY.
12. SET THE RAMMED UP FLASK ON THE POURING RACK WITH THE SPRUE TOWARD THE FURNACE.
13. REPLACE TOOLS AS YOU FINISH USING THEM.
14. PREPARE TO POUR 15 MINUTES BEFORE THE END OF THE PERIOD.
15. AT THE END OF THE DAY, COVER THE SAND AND SPRINKLE WITH WATER.
16. CLEAN SAND FROM CASTING BEFORE QUENCHING IN WATER. PARTS REQUIRING STRENGTH SHOULD NOT BE QUENCHED.
17. DO NOT QUENCH CASTINGS IN THE SINK.



GRINDER

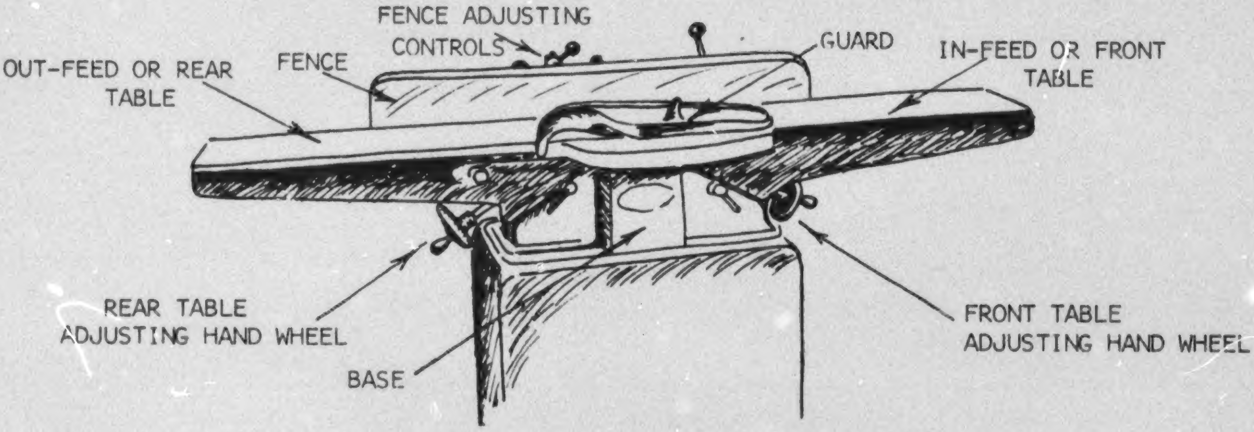
USES: GRINDERS ARE USED FOR SHAPING THE CUTTING EDGES OF TOOLS.

SAFETY PROCEDURE:

1. EYE SHIELDS MUST BE IN PROPER POSITION AND GOGGLES SHOULD BE WORN.
2. GUARDS AND TABLES SHOULD BE NO MORE THAN 1/8" AWAY FROM THE WHEEL.
3. TOOL BEING GROUND SHOULD BE HELD FIRMLY.
4. CLOGGED AND OUT-OF-TRUE WHEELS SHOULD BE DRESSED.
5. BADLY WORN WHEELS SHOULD BE REPLACED.
6. AVOID JAMMING TOOL.
7. ALWAYS USE THE FACE OF THE WHEEL.
8. REPLACEMENT WHEELS SHOULD BE THOSE RECOMMENDED FOR USE AT THE SPEED OF THE MACHINE.
9. STAY AT THE GRINDER UNTIL THE GRINDER HAS STOPPED.
10. MOVE THE WORK BACK AND FORTH, SO THE WHEEL WILL WEAR EVENLY.

OPERATING PROCEDURE:

1. ADJUST THE TOOL REST SLIGHTLY BELOW THE CENTER OF THE WHEEL FOR STRAIGHT-ON GRINDING AND ABOVE CENTER FOR BEVEL GRINDING.
2. DRESS THE TOOL CUTTING EDGE SQUARE WITH THE SIDES OF THE TOOL TO REMOVE NICKS.
3. WORK THE TOOL ACROSS THE FACE OF THE WHEEL WITH A LIGHT PRESSURE WHICH RESULTS IN A FINE CUT.
4. FREQUENTLY DIP THE TIP OF THE TOOL IN WATER TO COOL IT.
5. TURN OFF MACHINE AND DO NOT LEAVE UNTIL GRINDER HAS STOPPED.
6. DO NOT GRIND NON-FERROUS METALS, FOR EXAMPLE, ALUMINUM, BRASS, COPPER, ON ANY GRINDER IN THIS SHOP.


FENCE ADJUSTING CONTROLS
GUARD
OUT-FEED OR REAR TABLE
FENCE
IN-FEED OR FRONT TABLE
REAR TABLE ADJUSTING HAND WHEEL
BASE
FRONT TABLE ADJUSTING HAND WHEEL

JOINTER

USES: PLANING FACES AND EDGES STRAIGHT AND SMOOTH, CUTTING RABBETS, CHAMFERS AND BEVELS.

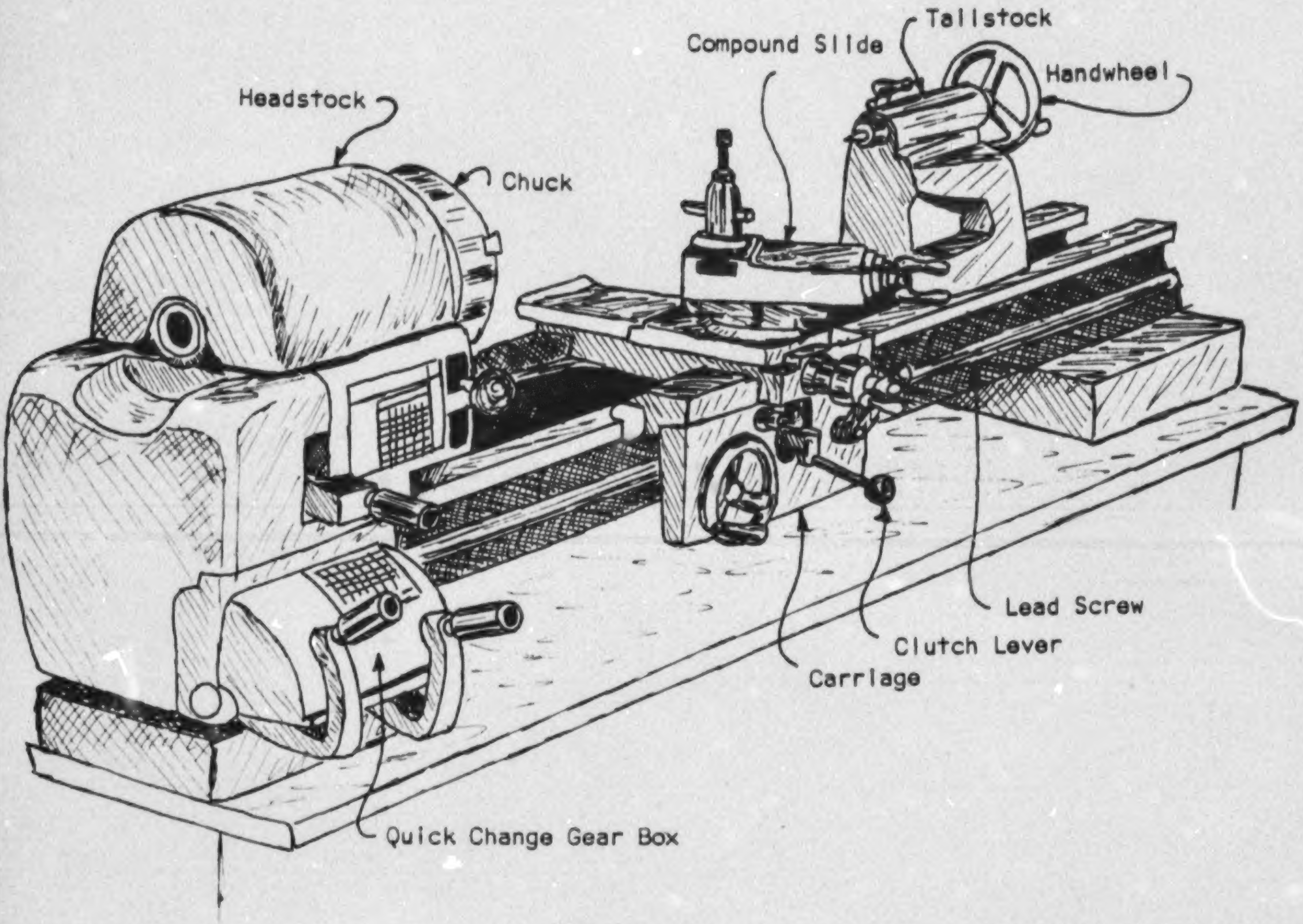
SAFETY PROCEDURE:

1. BEFORE TURNING POWER ON, CHECK DEPTH OF CUT AND POSITION OF FENCE. ALL ADJUSTMENTS OF THE FENCE MUST BE MADE WHEN CUTTERHEAD IS NOT ROTATING.
2. STAND TO THE LEFT SIDE WHILE OPERATING MACHINE.
3. MAXIMUM CUT FOR FACING A SIDE IS 1/16". MAXIMUM CUT FOR JOINTING AN EDGE IS 1/8".
4. STOCK MUST BE AT LEAST 12" LONG AND 2" WIDE TO BE FACED ON THE JOINTER. PUSH STICK OR BLOCK MUST BE USED WHEN WORKING NARROW OR THIN STOCK WHERE HANDS WOULD BE BELOW THE TOP OF THE FENCE.
5. FEED STOCK IN PROPER DIRECTION OF GRAIN.
6. USE STOCK THAT IS FREE FROM KNOTS, SPLITS AND CHECKS.
7. KEEP HANDS AWAY FROM CUTTER HEAD AND NEVER PASS THEM OVER IT WHEN FACING STOCK OR JOINTING NARROW PIECES.
8. WHEN WORK IS COMPLETE, TURN OFF MACHINE. REMAIN AT MACHINE UNTIL IT STOPS.

OPERATING PROCEDURE:

1. CHECK SQUARENESS OF FENCE TO REAR TABLE.
2. SET DEPTH OF CUT FROM 1/16" TO 1/8", DEPENDING ON CONDITION OF EDGE TO BE JOINTED. WHEN ADJUSTING FOR DEPTH, ALWAYS ADJUST TO A DEPTH GREATER THAN REQUIRED, THEN BACK TO THE DESIRED DEPTH. BE SURE LOCK BOLT IS LOOSE BEFORE ADJUSTING AND BE SURE IT IS TIGHT BEFORE OPERATION.
3. NOTIFY INSTRUCTOR BEFORE PROCEEDING BEYOND THIS STEP.
4. STAND TO LEFT SIDE AND TURN ON MOTOR.

5. VISUALLY CHECK FOR DIRECTION OF GRAIN.
6. HOLD THE FACED SIDE OF BOARD AGAINST THE FENCE WITH GRAIN POINTING DOWN AND TO THE REAR.
7. PASS STOCK OVER CUTTER HEAD AT A UNIFORM AND MODERATE RATE OF SPEED, KEEPING IT SECURE AGAINST FENCE AND REAR TABLE.
8. REPEAT OPERATION UNTIL EDGE IS STRAIGHT AND SMOOTH.
9. TURN OFF MOTOR AND WAIT AT MACHINE UNTIL IT STOPS.
10. NEVER ADJUST FRONT TABLE WITHOUT INSTRUCTOR'S PERMISSION.
11. DO NOT PASS YOUR HAND DIRECTLY OVER THE CUTTING HEAD UNLESS BOARD IS ABOVE THE FENCE.


Tailstock
Compound Slide
Handwheel
Headstock
Chuck
Lead Screw
Clutch Lever
Carriage
Quick Change Gear Box

METAL LATHE

USES: TO SHAPE METAL BY REVOLVING THE WORK AGAINST THE CUTTING EDGE OF A TOOL.

SAFETY PROCEDURE:

1. HAVE ALL NEW "SET UPS" CHECKED BEFORE STARTING.
2. WEAR SAFETY GLASSES OR GOGGLES AT ALL TIMES.
3. MAKE SURE STOCK IS SECURED IN EITHER A CHUCK OR DOG AND FACE PLATE.

4. ALL CHUCK TURNING IN THIS SHOP WILL REQUIRE THE STOCK TO BE FACED, CENTER DRILLED, AND SUPPORTED BY THE TAILSTOCK CENTER, UNLESS OTHERWISE DIRECTED BY THE INSTRUCTOR.
5. MAKE ALL ADJUSTMENTS BEFORE POWER IS TURNED ON.
6. CHECK FOR ADEQUATE CLEARANCE FOR THE CARRIAGE AND CUTTING TOOL BY MOVING THE CARRIAGE THE DISTANCE BETWEEN THE AREA TO BE CUT BEFORE THE POWER IS TURNED ON.
7. THE CUTTING TOOL SHOULD EXTEND FROM THE TOOL HOLDER ABOUT 1/2". THE TOOL HOLDER SHOULD BE FASTENED IN THE TOOL POST AS FAR BACK AS POSSIBLE. THE TOOL HOLDER AND TOOL POST RING AND WEDGE SHOULD ALWAYS BE ACROSS THE SLOT IN THE TOOL POST, NEVER TIGHTENED PARALLEL WITH THE SLOT.
8. MAKE SURE THE TAILSTOCK ALIGNMENT MARKS ARE CENTERED AND THAT THE TAPER ATTACHMENT IS DISENGAGED FOR STRAIGHT TURNING.
9. NEVER ENGAGE THE BACKGEAR, SLIDING GEAR, OR ADJUSTMENT LEVERS WITH THE MACHINE RUNNING.
10. KEEP THE COMPOUND REST EXTENDED BACK TOWARDS YOU AS FAR AS POSSIBLE.
11. HANDS SHOULD NEVER BE USED TO WIPE CHIPS FROM THE WORK.
12. NEVER MAKE A CUT TO THE END WITH POWER FEED. ALWAYS HAND FEED THE LAST 1/2".
13. REMOVE THE KEY FROM THE CHUCK WHENEVER STOCK IS TIGHTENED OR REMOVED FROM THE LATHE.
14. ALWAYS ROTATE THE SPINDLE BY HAND TO MAKE SURE EVERYTHING IS CLEAR BEFORE TURNING POWER ON.
15. DO NOT TALK TO ANYONE WHILE THE MACHINE IS RUNNING.
16. ONLY ONE PERSON SHOULD BE IN THE WORK AREA WHILE THE MACHINE IS RUNNING.
17. NEVER USE AIR PRESSURE TO CLEAN THE LATHES.
18. ALWAYS PLACE A BOARD UNDER THE CHUCK BEFORE REMOVING IT FROM THE SPINDLE.
19. NEVER OPERATE THE LATHE WITH CLOTHING LOOSE OR UNSECURED.
20. ALWAYS USE A SHARP CUTTING TOOL OF THE CORRECT TYPE FOR THE PARTICULAR JOB TO BE DONE.
21. BRUSH OFF CHIPS AND WIPE THE LATHE WITH CLOTH AFTER EVERY USE.
22. CUT STOCK 1" LONGER THAN THE PLANNED FINISH SIZE.

OPERATING PROCEDURE:

TURNING BETWEEN CENTERS

1. PREPARE THE STOCK FOR TURNING BETWEEN CENTERS BY FIRST CENTER DRILLING BOTH ENDS.
2. CHECK CENTER ALIGNMENT BY BRINGING THE HEADSTOCK AND TAILSTOCK CENTERS TOGETHER. OUT OF LINE CENTERS WILL RESULT IN A WORK-PIECE THAT IS ECCENTRIC OR IS UNTRUE IN ITS DIAMETER FROM ONE END TO ANOTHER.
3. PLACE STOCK IN LATHE DOG OF PROPER SIZE AND TIGHTEN. THE DOG SHOULD BE CLAMPED NEAR THE END OF THE WORK PIECE.

METAL LATHE (CON'T)

4. INSTALL A FACE PLATE AND INSERT THE BENT TAIL OF THE LATHE DOG THROUGH ONE OF THE SLOTS IN THE FACE PLATE.

5. TIGHTEN THE TAILSTOCK SO THAT THE DOG DOES NOT CLATTER AGAINST THE FACE PLATE WHEN OPERATING.

6. CHECK TO DETERMINE HOW FAR THE CARRIAGE CAN BE MOVED TO THE LEFT WITHOUT DANGER OF THE DOG STRIKING THE COMPOUND REST.

7. USE A LEFT HAND TOOL HOLDER TO SUPPORT THE CUTTER BIT. POSITION THE TOOL POST AS FAR TO THE LEFT IN THE COMPOUND REST T-SLOT AS POSSIBLE.

8. WHEN MOUNTING THE TOOL HOLDER, DO NOT PERMIT TOO MUCH OVERHANG.

9. KEEP THE CUTTING TOOL WELL BACK IN THE TOOL HOLDER AND MAKE SURE IT IS SHARP.

10. THE CUTTING TOOL SHOULD BE ADJUSTED ON CENTER BY LINING IT UP WITH THE POINT OF THE LINE CENTER IN THE HEADSTOCK.

11. BE SURE TO ADJUST THE TOOL HOLDER SO THAT IT IS ANGLED SLIGHTLY AWAY FROM THE DIRECTION OF THE CUT TO BE MADE. THIS WILL PREVENT THE CUTTING BIT FROM DIGGING INTO THE WORK PIECE.

12. FOR ROUGH CENTER TURNING, THE MACHINE SHOULD BE SET SO THAT YOU CAN SAFELY TAKE OFF A MAXIMUM OF STOCK IN A SHORT TIME.

13. REDUCE THE DIAMETER TO WITHIN 1/32" OF THE REQUIRED SIZE.

14. THE COMPOUND REST SHOULD BE SET AT 30 DEGREES TO THE WORK.

15. FOR FINISH TURNING, USE A LEFT, RIGHT, OR STRAIGHT ROUND NOSE FINISHING TOOL.

16. BE SURE TO COMPLETELY STOP THE MACHINE BEFORE REVERSING THE FEED DIRECTION OR MAKING ANY OTHER ADJUSTMENTS.

17. IF THE WORK PIECE MUST BE REVERSED TO MACHINE ITS ENTIRE LENGTH, PROTECT THE SECTION UNDER THE LATHE DOG SETSCREW BY INSERTING A PIECE OF ALUMINUM OR COPPER.

18. WEAR SAFETY GLASSES OR GOGGLES.

FACING OPERATION

1. USE A SHARP FACING TOOL INSTALLED IN A STRAIGHT OR OFFSET TOOL HOLDER.

2. SET THE SPEED AND FEED ADJUSTMENTS FOR THE TYPE OF MATERIAL TO BE FACED.

3. REMOVE ENOUGH MATERIAL SO THAT THE FACE OR END OF THE STOCK IS FLAT AND SMOOTH. MAKE THE FINAL OR FINISH CUT FROM THE CENTER OUT.

CHUCK TURNING

1. THE PIECE TO BE TURNED IN THE CHUCK MUST FIRST BE FACED AND CENTER DRILLED. PIECES OF STOCK WITH LARGER DIAMETERS NEED NOT BE CENTER DRILLED AND SUPPORTED BY THE TAILSTOCK CENTER. CHECK WITH THE INSTRUCTOR ABOUT THIS AS IT CONCERNS YOUR PARTICULAR JOB.

2. SELECT A ROUND NOSE OR ROUGHING TOOL THAT IS SHARP AND INSTALL IT IN A STRAIGHT OR OFFSET TOOL HOLDER.

3. TIGHTEN STOCK IN THE CHUCK AND SUPPORT END WITH TAILSTOCK CENTER.

4. ADJUST THE MACHINE SPEED AND FEED FOR THE TYPE METAL TO BE MACHINED. GENERALLY THE HARDER THE METAL, THE SLOWER THE SPEED AND FEED. FOR ROUGHING OPERATIONS, THE FEED AND DEPTH OF CUT ARE ACCORDING TO WHAT THE MACHINE WILL TAKE. CHECK WITH THE INSTRUCTOR ON THIS BEFORE STARTING.
5. FINISH CUTS SHOULD BE MADE AT HIGHER SPEEDS AND SLOWER FEED, USING SHALLOWER DEPTH OF CUT.
6. BE SURE THE CARRIAGE HAS FREEDOM TO MOVE THE FULL LENGTH OF THE INTENDED CUT WITHOUT HITTING THE CHUCK OR TAILSTOCK.
7. MAKE ALL CUTS UP TO A SHOULDER BY HAND, NEVER UNDER POWER.
8. CUT STOCK APPROXIMATELY 1" LONGER THAN THE FINISH SIZE TO ALLOW FOR REMOVAL OF CENTER HOLES.
9. WHEN INSTALLING THE CHUCK, ALWAYS PLACE A BOARD ACROSS THE WAYS OF THE BED.
10. WEAR SAFETY GLASSES OR GOGGLES AT ALL TIMES WHEN TURNING.
11. ALWAYS REMOVE THE CHUCK KEY.

CENTER DRILLING

1. THE WORK PIECE MUST BE PROPERLY FACED BEFORE STARTING THIS OPERATION.
2. MOUNT THE WORK TO BE CENTER DRILLED CLOSE TO THE JAWS OF THE CHUCK.
3. SELECT A MEDIUM HIGH SPEED.
4. REMOVE THE TOOL HOLDER FROM THE TOOL POST AND EXTEND THE CROSSFEED BACK TOWARD YOU.
5. BE SURE THAT THE TAILSTOCK "WITNESS MARKS" ARE ALIGNED.
6. SELECT THE PROPER SIZE CENTER DRILL FOR YOUR SIZE WORK (CHECK WITH YOUR INSTRUCTOR) AND INSTALL IT INTO A JACOBS CHUCK. CHECK THE CHUCK FOR THE PROPER MORSE TAPER FOR THE LATHE YOU ARE USING.
7. BRING THE TAILSTOCK UP CLOSE TO THE END OF YOUR WORK WITH THE SPINDLE EXTENDED ONLY SLIGHTLY. LOCK THE TAILSTOCK IN POSITION.
8. TURN ON POWER AND DRILL INTO END OF STOCK SLOWLY.
9. DRILL THE CENTER HOLE ONLY DEEP ENOUGH SO THAT THE TAILSTOCK CENTER FITS PROPERLY INTO THE TAPERED SIDES OF THE HOLE.
10. WEAR SAFETY GLASSES OR GOGGLES.

TAPERING

1. TAPERS CAN BE TURNED BY FOUR METHODS ON THE LATHE. THESE ARE THE TAPER ATTACHMENT, COMPOUND REST, TAILSTOCK OFFSET, AND BY USING A SPECIALLY GROUND TOOL.
2. IF THE TAPER IS TO BE MADE WITH THE TAILSTOCK SET-OVER, THE WORK MUST BE HELD BETWEEN CENTERS. ONLY EXTERNAL TAPERS CAN BE MADE WITH THIS METHOD.
3. DETERMINE THE TAPER ANGLE IN DEGREES OR INCHES PER FOOT. IF THE TAPER IS NOT GIVEN ON THE PLANS, IT CAN BE EASILY FIGURED BY USING ONE OF THE METHODS IN YOUR TEXTBOOK (MODERN METALWORKING, PP. 36-26 AND 36-27.)

4. USE THE TAPER ATTACHMENT IF THE MACHINE IS EQUIPPED WITH ONE.
5. IF THE OFFSET TAILSTOCK METHOD IS USED, FIRST PREPARE YOUR STOCK BY FACING AND CENTER DRILLING IN A CHUCK.
6. THEN LOOSEN THE TAILSTOCK CLAMP AND TURN THE SETSCREW IN THE TAILSTOCK ON THE OPERATOR'S SIDE OUT. THE AMOUNT OF TAILSTOCK OFFSET CAN BE MEASURED BETWEEN THE CENTERS OR TAKEN FROM THE "WITNESS MARKS" ON THE END OF THE TAILSTOCK. WHEN THIS IS COMPLETED, ADJUST THE OTHER SETSCREW ON THE OPPOSITE SIDE OF THE TAILSTOCK IN AS FAR AS IT WILL GO. RECHECK THE OFFSET AGAIN BEFORE THE FIRST CUT IS TAKEN.
7. SET THE SPEED AND FEED ADJUSTMENTS AS FOR OTHER ROUGHING OPERATIONS.
8. CHECK FOR ADEQUATE CLEARANCE BETWEEN THE ENTIRE SECTION TO BE TAPERED. THE CARRIAGE SHOULD HAVE FREEDOM OF TRAVEL, AND THE CUTTING TOOL SHOULD BE POSITIONED TO CUT IN THE PROPER DIRECTION.
9. THE SECTION TO BE TAPERED SHOULD BE MARKED OFF SO THAT IT CAN EASILY BE SEEN.
10. USE A ROUGHING TOOL FOR THE ROUGH CUTS AND A ROUND NOSE FINISH BIT FOR THE FINAL CUT.
11. WEAR SAFETY GLASSES OR GOGGLES.

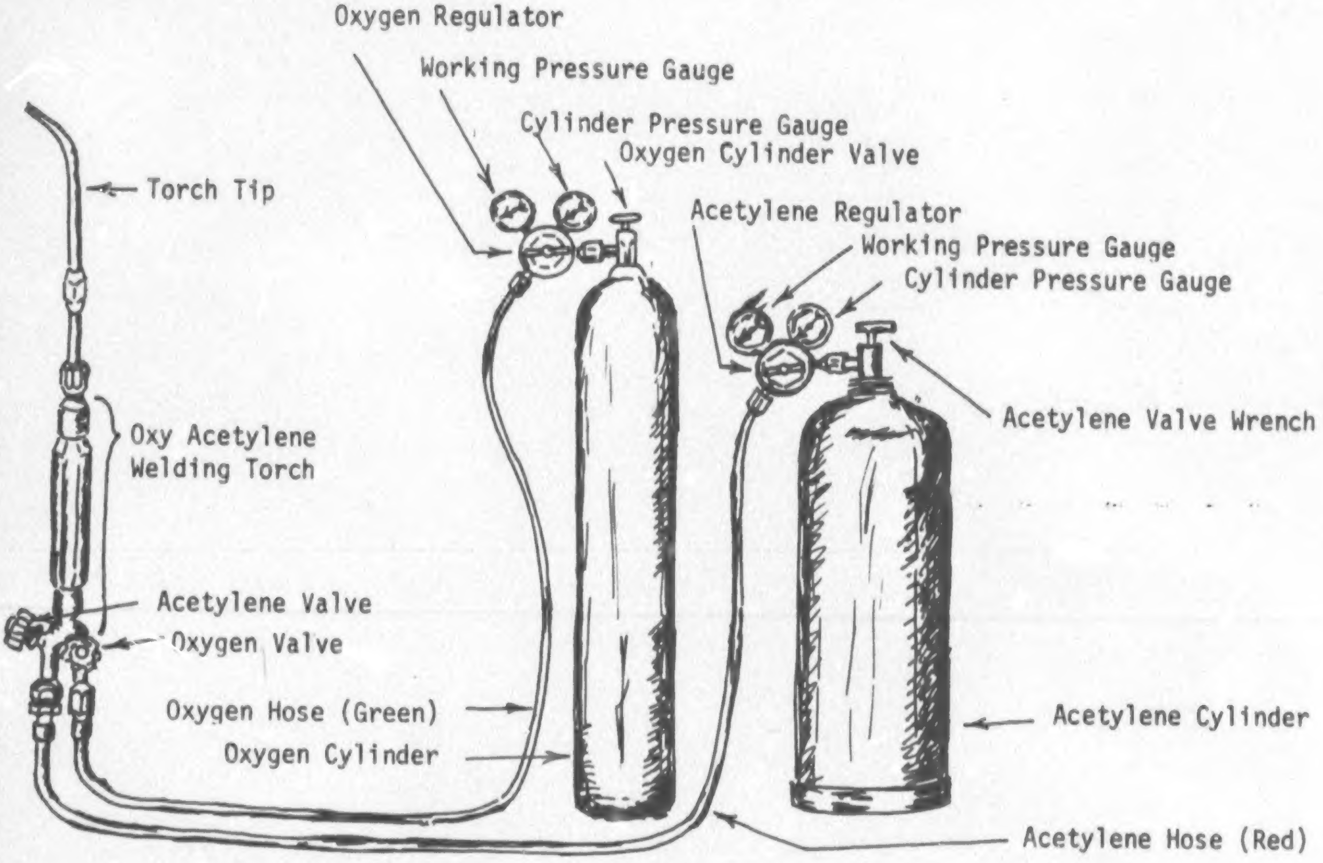
FILING AND POLISHING

1. MOST WORK WILL NOT REQUIRE FILING AND POLISHING IF THE FINISHING CUT HAS BEEN PROPERLY MADE WITH A VERY SHARP FINISHING TOOL.
2. FILING AND POLISHING ARE NEVER DONE WHEN ACCURAGE DIMENSIONS MUST BE MAINTAINED.
3. FILING SHOULD BE DONE ON THE LATHE, WITH A 10-12 INCH MILL FILE OR LONG LATHE FILE.
4. TO FILE, FIRST ADJUST THE MACHINE TO RELATIVELY HIGH SPEED AND MAKE SURE THE WORK IS WELL SECURED EITHER BETWEEN CENTERS OR IN A CHUCK.
5. REMOVE THE TOOL POST AND MOVE THE CARRIAGE OUT OF YOUR WAY.
6. IF YOU ARE USING A LATHE DOG TO DRIVE THE WORK, BE VERY CAREFUL THAT YOU DO NOT GET HIT WHEN FILING OR POLISHING.
7. THE SAFEST METHOD OF FILING ON THE LATHE (BETWEEN CENTERS OR WITH A CHUCK) IS THE LEFT HAND METHOD.
8. START AT THE HEADSTOCK END OF THE SURFACE TO BE FILED, AND USE LONG, EVEN STROKES.
9. MOVE THE FILE OVER ABOUT HALF ITS WIDTH AFTER EACH STROKE.
10. DO NOT USE HEAVY PRESSURE BECAUSE THIS WILL CAUSE THE FILE TEETH TO CLOG.
11. CLEAN THE FILE AFTER EVERY 2-3 STROKES. CHALK MAY BE RUBBED INTO THE TEETH TO HELP KEEP THEM CLEAN.
12. TO POLISH ON THE LATHE, USE THE HIGHEST SPEED. START THE POLISHING OPERATION BY USING A COARSENESS GRADE OF POLISHING PAPER EQUIVALENT TO THE COARSENESS OF YOUR WORK SURFACE. WORK DOWN TO THE FINEST GRID, AND IF DESIRED, FINISH ON THE BUFFER.

13. NEVER WRAP THE ABRASIVE CLOTH AROUND YOUR WORK, BUT HOLD IT LOOSELY IN BOTH HANDS LOOPED AROUND THE WORK.
14. A FILE OR A BLOCK OF WOOD MAY ALSO BE USED TO GIVE ADDED SUPPORT TO THE ABRASIVE CLOTH WHILE POLISHING.
15. WEAR SAFETY GLASSES OR GOGGLES.
16. CLEAN THE MACHINE THOROUGHLY AFTER POLISHING OPERATIONS. THE ABRASIVE GRIT CAUSES EXTREME WEAR TO LATHE PARTS IF NOT REMOVED.

KNURLING

1. THE WORK PIECE SHOULD BE TURNED TO A UNIFORM SMOOTHNESS BEFORE THE KNURLING OPERATION IS STARTED.
2. ADJUST THE MACHINE SO THAT IT IS ENGAGED IN BACK GEAR. THIS ADJUSTMENT IS DIFFERENT ON SOME MACHINES THAN OTHERS, SO KNOW YOUR MACHINE.
3. KNURLING CAN BE ACCOMPLISHED BETWEEN CENTERS OR IN A CHUCK WITH THE TAILSTOCK CENTER SUPPORTING THE END.
4. LAY OFF THE ENDS OF STOCK TO BE KNURLED.
5. MOUNT THE KNURLING TOOL IN THE TOOL POST AND ADJUST IT UP OR DOWN SO THE LINE OF THRUST WILL PASS THROUGH THE CENTER OF THE WORK AND BETWEEN THE TWO WHEELS WHEN THE TOOL IS FORCED INTO THE WORK. TURN THE TOOL VERY SLIGHTLY TOWARD THE HEADSTOCK.
6. ADJUST THE LONGITUDINAL FEED FOR A SLOW TO MEDIUM TRAVEL.
7. MOVE THE CARRIAGE TO LINE UP THE RIGHT HAND EDGE OF THE KNURLS WITH THE RIGHT HAND EDGE OF THE SECTION TO BE KNURLED.
8. START THE LATHE AND TURN THE CROSSFEED UNTIL THE WHEELS BITE INTO THE METAL. APPLY A CUTTING FLUID.
9. IF THE WORK PIECE IS HEAVY, THE WHEELS CAN BE PUSHED IN TO FORM THE FULL DEPTH OF THE KNURL. FOR SMALLER DIAMETER WORK, ONLY A SHALLOW IMPRESSION SHOULD BE MADE.
10. ENGAGE THE LONGITUDINAL FEED AND CONTINUE TO APPLY FLUID.
11. KEEP THE WHEELS CLEAN WITH A BRUSH, BEING CAREFUL NOT TO GET IT CAUGHT IN THE WHEELS.
12. AT THE END OF THE KNURLED SECTION, STOP THE LATHE BUT DO NOT DISENGAGE THE POWER FEED OR RELEASE THE PRESSURE.
13. INSPECT THE KNURL. IF IT ISN'T DEEP ENOUGH, REVERSE THE POWER FEED AND TURN ON THE POWER. IMMEDIATELY TURN THE CROSS-FEED IN TO OBTAIN A DEEPER IMPRESSION. IF AN ADDITIONAL PASS IS NECESSARY, REVERSE THE POWER AGAIN AND USE THE SAME PROCEDURE.
14. KEEP FINGERS AWAY FROM THE KNURLING WHEELS.
15. REMOVE THE KNURLED PIECE AND LIGHTLY WIRE WHEEL IF THE KNURL FEELS SHARP TO THE TOUCH.


Oxygen Regulator
Working Pressure Gauge
Cylinder Pressure Gauge
Oxygen Cylinder Valve
Torch Tip
Acetylene Regulator
Working Pressure Gauge
Cylinder Pressure Gauge
Acetylene Valve Wrench
Oxy Acetylene Welding Torch
Acetylene Valve
Oxygen Valve
Oxygen Hose (Green)
Oxygen Cylinder
Acetylene Cylinder
Acetylene Hose (Red)

ACETYLENE WELDING

USES: CUT, FUSE AND BRAZE METAL.

SAFETY PROCEDURE:

GAS WELDING AND CUTTING

1. NEVER USE OIL OR GREASE AROUND OR IN ANY PART OF WELDING OR CUTTING APPARATUS. EVEN A TRACE OF OIL OR GREASE CAN CAUSE A SERIOUS FIRE OR EXPLOSION.
2. ALWAYS STAND TO THE SIDE OF THE REGULATOR WHEN YOU ARE TURNING ON THE CYLINDER VALVE.
3. BE SURE THE REGULATOR ADJUSTING SCREW HAS BEEN RELEASED BY TURNING CYLINDER VALVE COUNTERCLOCKWISE, BEFORE TURNING ON THE OXYGEN OR ACETYLENE.
4. TURN THE OXYGEN CYLINDER VALVE ON VERY SLOWLY UNTIL THE MAXIMUM CYLINDER PRESSURE REGISTERS ON THE REGULATOR GAUGE. THEN OPEN THE VALVE COMPLETELY.
5. DO NOT OPEN THE ACETYLENE VALVE MORE THAN 1/4 TURN.
6. WHEN TESTING FOR GAS LEAKS, USE SOAP AND WATER.
7. DO NOT USE UNDUE FORCE IN TRYING TO OPEN OR CLOSE A CYLINDER VALVE.
8. OBSERVE FIRE PREVENTION PROCEDURES AND KNOW WHERE THE FIRE EXTINGUISHER IS LOCATED.

9. NEVER HEAT A GAS CYLINDER BY PLAYING A FLAME ON THE CYLINDER WALLS. IT COULD CAUSE THE CYLINDER TO EXPLODE.
10. ALWAYS USE PROPER GOGGLES WHEN WELDING OR CUTTING.
11. KEEP SPARKS AWAY FROM HOSES OR CYLINDERS. IF UNSURE OF A PROCEDURE, GET THE CORRECT ANSWER FROM A QUALIFIED PERSON.
12. CARE SHOULD BE USED WHEN HANDLING THE WELDING AND CUTTING APPARATUS. THEY ARE PRECISION TOOLS AND WILL SERVE YOU A LONG TIME IF PROPERLY USED.
13. MAKE SURE THAT THE ACETYLENE CYLINDER IS ALWAYS KEPT CHAINED IN AN UPRIGHT POSITION.
14. ALWAYS LEAVE THE WRENCH IN PLACE ON THE ACETYLENE CYLINDER SO IT MAY BE SHUT OFF QUICKLY IN AN EMERGENCY.
15. ALWAYS MAKE SURE THE TORCH IS POINTING IN A SAFE DIRECTION WHEN LIGHTING.
16. ALWAYS KEEP ACETYLENE PRESSURE BELOW 15 LBS./SQ. IN.

OPERATING PROCEDURE

LIGHTING PROCEDURE WELDING

1. CHECK AND MAKE SURE THE REGULATOR ADJUSTING SCREWS ARE LOOSE AND TORCH VALVES CLOSED.
2. OPEN OXYGEN CYLINDER VALVE VERY SLOWLY TO PREVENT DAMAGE TO THE REGULATOR DIAPHRAM. WHEN THE HIGH PRESSURE GAUGE REACHES ITS MAXIMUM READING, TURN THE CYLINDER VALVE ABOUT ONE TURN.
3. OPEN THE ACETYLENE CYLINDER VALVE SLOWLY TO 1/4 TURN.
4. TURN THE OXYGEN REGULATOR ADJUSTING SCREWS IN UNTIL THE LINE-PRESSURE OXYGEN GAUGE INDICATES THE DESIRED PRESSURE (SEE TIP CHART).
5. ADJUST THE ACETYLENE TO DESIRED PRESSURE IN THE SAME MANNER AS THE OXYGEN. NEVER EXCEED 15 LBX./SQ.IN.
6. OPEN THE ACETYLENE TORCH VALVE SLIGHTLY, NO MORE THAN 1/16 OF A TURN AND USING A FLINT LIGHTER, IGNITE THE ACETYLENE GAS COMING FROM THE TIP.
7. NEXT TURN THE ACETYLENE TORCH VALVE UNTIL THE FLAME STOPS SMOKING.
8. NEXT SLOWLY TURN TORCH OXYGEN VALVE UNTIL NEUTRAL FLAME IS OBTAINED. (SEE FLAME CHART.) THE TORCH IS NOW READY FOR USE.

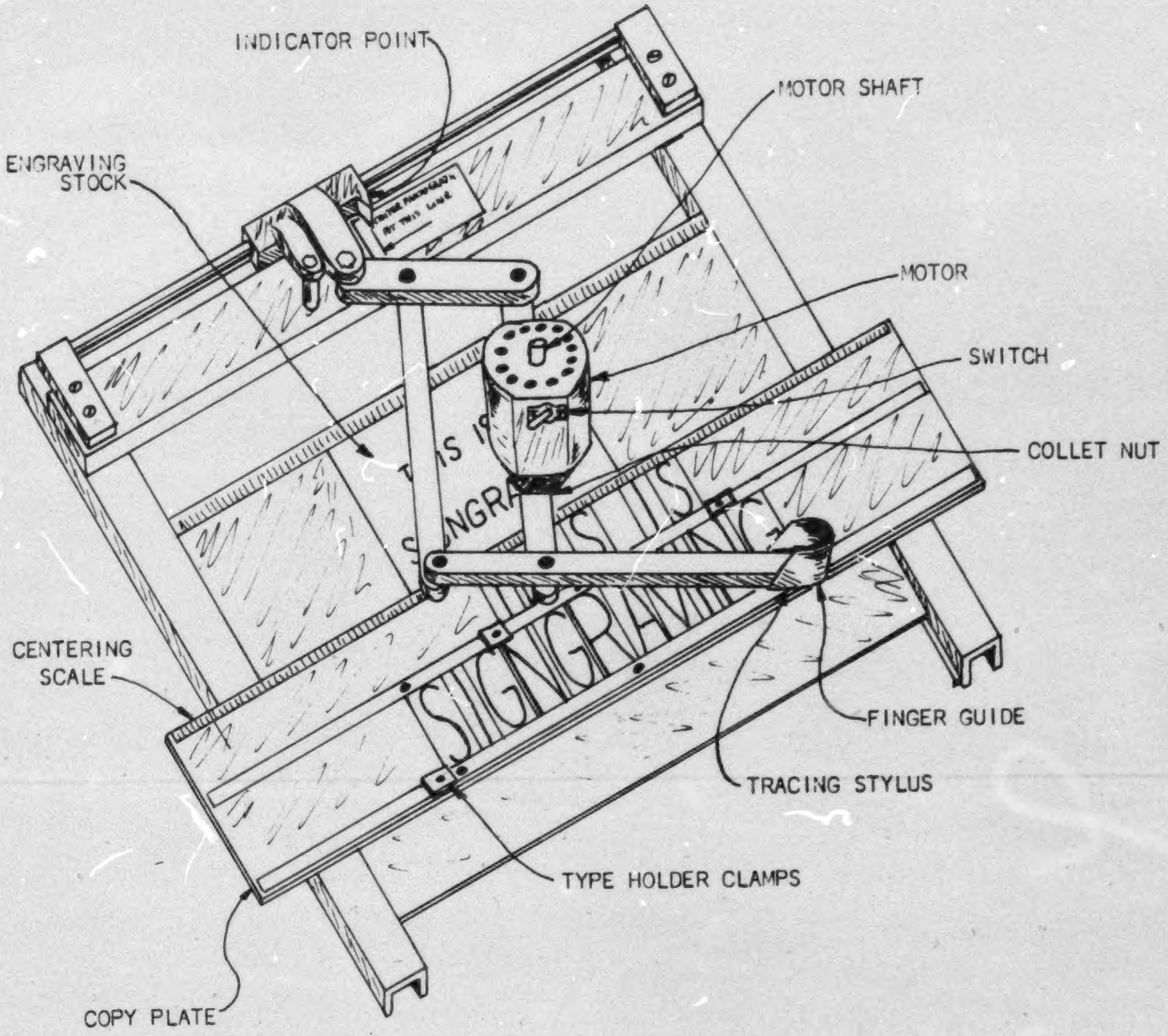
SHUTTING OFF TORCH

1. CLOSE THE HAND VALVES ON THE TORCH, FIRST THE OXYGEN, THEN THE ACETYLENE.
2. CLOSE BOTH CYLINDER VALVES.
3. OPEN THE TORCH OXYGEN VALVE AND LET THE OXYGEN IN THE LINE DRAIN OUT.
4. RELEASE THE ADJUSTING SCREW ON THE REGULATOR BY TURNING IT COUNTER-CLOCKWISE UNTIL LOOSE.
5. CLOSE THE TORCH OXYGEN VALVE.

6. OPEN THE TORCH FUEL VALVE (ACETYLENE) AND RELEASE PRESSURE IN THE LINES.
7. RELEASE THE ADJUSTING SCREW ON THE FUEL GAS REGULATOR AS YOU DID ON THE OXYGEN.
8. CLOSE THE TORCH FUEL VALVE.

CUTTING

1. TO LIGHT TORCH, SET THE REGULATORS FOR EACH GAS AS SPECIFIED IN PRESSURE CHART.
2. DEPRESS CUTTING OXYGEN LEVER TO PURGE THE CUTTING PASSAGES OF THE TORCH.
3. OPEN FUEL VALVE ABOUT 1/4 TURN AND IGNITE WITH SPARK LIGHTER.
4. ADJUST VALVE UNTIL ACETYLENE FLAME STOPS SMOKING.
5. WITH PREHEAT OXYGEN VALVE CLOSED, OPEN TORCH OXYGEN VALVE COMPLETELY.
6. SLOWLY OPEN THE PREHEAT OXYGEN VALVE UNTIL A NEUTRAL FLAME IS ESTABLISHED.
7. AFTER THE NEUTRAL FLAME HAS BEEN ESTABLISHED, DEPRESS THE CUTTING OXYGEN LEVER. NOTE THAT THE PREHEAT FLAMES CHANGE SLIGHTLY FROM NEUTRAL TO CARBURIZING FLAME.
8. WITH THE CUTTING OXYGEN LEVER IN THE DEPRESSED POSITION, READJUST THE PREHEAT OXYGEN VALVE UNTIL THE PREHEAT FLAMES ARE AGAIN NEUTRAL.
9. THE TORCH IS NOW READY FOR USE.


INDICATOR POINT
ENGRAVING STOCK
MOTOR SHAFT
MOTOR
SWITCH
COLLET NUT
SIGNGRAVING
CENTERING SCALE
FINGER GUIDE
TRACING STYLUS
TYPE HOLDER CLAMPS
COPY PLATE

PANTOGRAPH

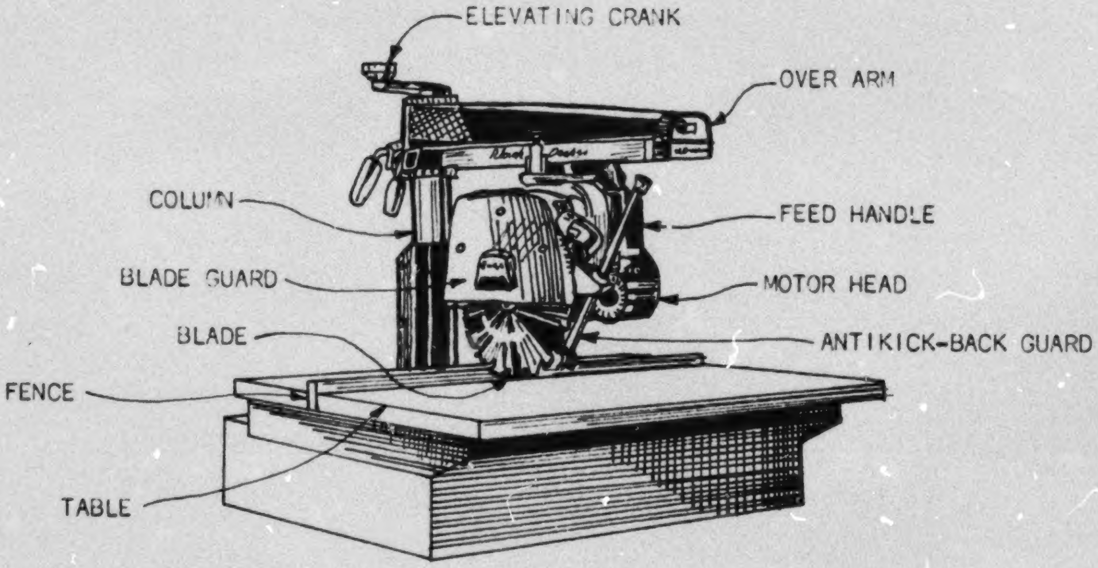
SAFETY PROCEDURE:

1. WEAR SAFETY GLASSES OR GOGGLES.
2. KEEP CLOTHING AWAY FROM THE ROTATING MOTOR SHAFT.
3. BE SURE TO REMOVE TOOLS FROM THE MOTOR SHAFT AFTER THE CUTTING BIT HAS BEEN TIGHTENED.
4. UNPLUG THE MOTOR WHILE MAKING ADJUSTMENTS.
5. HANDLE THE MACHINE CAREFULLY!

OPERATING PROCEDURE:

1. LIFT THE MACHINE BY THE FINGER GUIDE INTO AN UPRIGHT POSITION.

2. REMOVE THE DEPTH STOP BY TURNING IT TO THE LEFT.
3. PLACE AN ALLEN WRENCH INTO THE UPPER END OF THE MOTOR SHAFT. HOLDING THE ALLEN WRENCH IN ONE HAND, LOOSEN THE COLLET NUT WITH THE OTHER HAND.
4. SELECT A CUTTER ACCORDING TO THE SIZE OF THE ENGRAVING BEING MADE. BIT SIZES ARE: 1/64, 1/32, 1/16, 3/32.
5. PUT THE CUTTER INTO THE COLLET AND TIGHTEN THE COLLET NUT SO THAT THE TOOL BIT EXTENDS 3/8" BELOW THE COLLET NUT. USE THE TOOL DEPTH GAUGE TO ADJUST THE CUTTER DEPTH.
6. REPLACE THE DEPTH STOP AND TIGHTEN GENTLY.
7. LOWER THE MACHINE SLOWLY UNTIL IT RESTS ON THE PANTOGRAPH BODY.
8. BE SURE THAT THE INDICATOR POINTER IS CENTERED ON THE LINE ON THE PANTOGRAPH BODY.
9. CHOOSE THE LETTERS OR DESIGN TO BE REPRODUCED.
10. LOOSEN THE TYPE HOLDER CLAMPS AND TYPE HOLDER BARS.
11. PLACE THE LETTERS OR DESIGN ON THE COPY PLATE AND CENTER USING THE MASTER TYPE CENTERING SCALE.
12. SLIDE THE TYPE HOLDER BAR FORWARD UNTIL THE LETTERS OR DESIGN ARE HELD FIRMLY IN PLACE, THEN TIGHTEN THE TYPE HOLDER BAR SCREWS. TIGHTEN GENTLY.
13. SLIDE THE TYPE HOLDER CLAMPS INTO PLACE AGAINST THE LETTERS AND TIGHTEN GENTLY.
14. CENTER THE ENGRAVING STOCK IN THE MATERIAL HOLDING CLAMPS.
15. PLACE THE TRACING STYLUS IN THE UPPER LEFT HAND CORNER OF THE FIRST LETTER.
16. LOOSEN THE WORK PLATE CLAMPING KNOB AND SLIDE THE ENGRAVING STOCK FORWARD OR BACKWARD UNTIL CENTERED.
17. PLACE THE STYLUS IN THE FIRST LETTER AND START THE MOTOR.
18. PUSH THE FINGER GUIDE DOWN UNTIL THE DEPTH STOP MAKES CONTACT WITH THE ENGRAVING STOCK.
19. TRACE EACH LETTER BEING SURE TO KEEP A STEADY PRESSURE DOWNWARD ON THE FINGER GUIDE.
20. AFTER ALL THE LETTERS OR LINES HAVE BEEN TRACED, SHUT OFF THE MOTOR, UNPLUG AND RAISE THE MOTOR ASSEMBLY INTO AN UPRIGHT POSITION.
21. REMOVE THE CUTTER BIT, AND REPLACE THE DEPTH STOP.
22. REMOVE THE COMPLETED ENGRAVING AND REPLACE THE LETTERS INTO THE JOB CASE IN THEIR PROPER PLACES.
23. LOWER THE MOTOR ASSEMBLY INTO A RESTING POSITION.
24. CLEAN UP THE WORK AREA AND RETURN TOOLS TO THEIR PLACES.



RADIAL ARM SAW

USES: CROSSCUTTING, DADOING AND VARIOUS WOOD CUTS.

SAFETY PROCEDURE:

1. ALWAYS KEEP THE GUARD IN PLACE DURING ALL CUTTING OPERATIONS.
2. FOR THE PURPOSE OF THIS SHOP, ALL RIPPING OPERATIONS WILL BE DONE ON THE TABLE SAW. DO NOT RIP ON THE RADIAL ARM SAW.
3. MAKE LAYOUT ON STOCK PRIOR TO PERFORMING CUTTING OPERATIONS.
4. ADJUST SAW HEIGHTS DEPENDING ON THE PROJECT REQUIREMENTS.
5. SELECT PROPER BLADE FOR THE WORK TO BE DONE. IN MOST CASES, A SHARP COMBINATION BLADE WILL SUFFICE FOR ALL CROSSCUTTING OPERATIONS.
6. ALWAYS MAKE SURE STOCK IS TIGHT AGAINST FENCE OR BACK BOARD PRIOR TO SAWING.
7. OPERATOR POSITION WHEN USING THE RADIAL ARM SAW IS MOST IMPORTANT. WHEN STANDING TO THE RIGHT OF THE SAW, HOLD STOCK WITH RIGHT HAND AND DRAW SAW THROUGH STOCK WITH LEFT HAND. WHEN STANDING TO THE LEFT OF THE SAW. HOLD STOCK WITH LEFT HAND AND DRAW SAW THROUGH STOCK WITH RIGHT HAND. NEVER CROSS ARM.
8. ALWAYS KEEP FINGERS WELL CLEAR OF SAW BLADE'S PATH.
9. WHEN STARTING THE SAW, MAKE SURE ALL TOOLS AND WOOD IS CLEAR OF THE BLADE. ALSO, MAKE SURE SAW HEAD IS PUSHED ALL THE WAY BACK. DO NOT START SAW WHEN THE BLADE IS TOUCHING PROJECT STOCK.
10. A RADIAL ARM SAW HAS A TENDENCY TO PULL ITSELF INTO THE STOCK. A HOLDING BACK AS WELL AS A PULLING THROUGH MOTION OF THE SAW HEAD IS NECESSARY TO MAINTAIN A SMOOTH CUTTING ACTION.
11. WHEN THE CUT HAS BEEN MADE, TURN OFF THE SAW AND ALLOW THE BLADE TO COMPLETELY STOP BEFORE REMOVING SCRAP AND/OR MAKING ADDITIONAL SAW ADJUSTMENTS.
12. ALWAYS RETURN THE SAW TO THE REAR OF THE TABLE AFTER COMPLETING THE CUT.

OPERATING PROCEDURE:

CROSSCUTTING

1. ADJUST MOTOR SO BLADE WILL BE A RIGHT ANGLE TO THE TOP.
2. ADJUST RADIAL ARM TO ZERO (RIGHT ANGLES TO THE GUIDE FENCE).
3. TURN THE ELEVATING HANDLE DOWN UNTIL THE TEETH ARE ABOUT 1/16" BELOW THE SURFACE OF THE WOOD TABLE. THE BLADE SHOULD FOLLOW THE CUT ALREADY CUT IN THE TABLE.
4. PLACE THE STOCK ON THE TABLE WITH THE LAYOUT LINE IN THE PATH OF THE SAW. MAKE SURE THAT THE STOCK IS HELD FIRMLY TO THE TABLE.
5. TURN POWER ON AND ALLOW SAW TO REACH FULL SPEED.
6. USING THE MOTOR YOKE HANDLE, PULL THE SAW FIRMLY BUT SLOWLY THROUGH THE WORK.
7. KEEP YOUR HANDS AWAY FROM THE DANGER AREA - THE PATH OF THE SAW BLADE.
8. WHEN THE CUT IS FINISHED, RETURN SAW BACK BEYOND THE GUIDE FENCE AND TURN OFF POWER.

DADOING

1. MOUNT A DADO HEAD ON THE ARBOR SHAFT. INSTALL THE NECESSARY BLADES AND CUTTERS TO OBTAIN CORRECT WIDTH.
2. MARK LOCATION OF DADO ON THE FACE OF THE STOCK.
3. ADJUST THE DEPTH OF CUT. TURN THE ELEVATING HANDLE UNTIL THE DADO HEAD TOUCHES THE WORK. THEN LOWER THE DADO HEAD TO THE DESIRED DEPTH. EACH TURN OF THE HANDLE LOWER IS ONE-EIGHTH INCH.
4. TRY DADO CUT ON A SCRAP PIECE OF WOOD.
5. PLACE THE STOCK TO BE CUT ON THE TABLE AND CAREFULLY PULL THE BLADE ACROSS THE STOCK USING LAYOUT LINE AS A GUIDE.

ANGLE CUTTING

1. TO TILT MOTOR TO 45°, PULL OUT BEVEL LATCH.
2. TO SWING THE RADIAL ARM FOR A MITER CUT, RELEASE THE ARM CLAMP HANDLE AND MOVE THE ARM TO DESIRED ANGLE.
3. TO MAKE COMPOUND BEVEL AND MITER CUT, TURN THE MOTOR TO THE CORRECT ANGLE AND MOVE THE ARM TO THE CORRECT ANGLE.

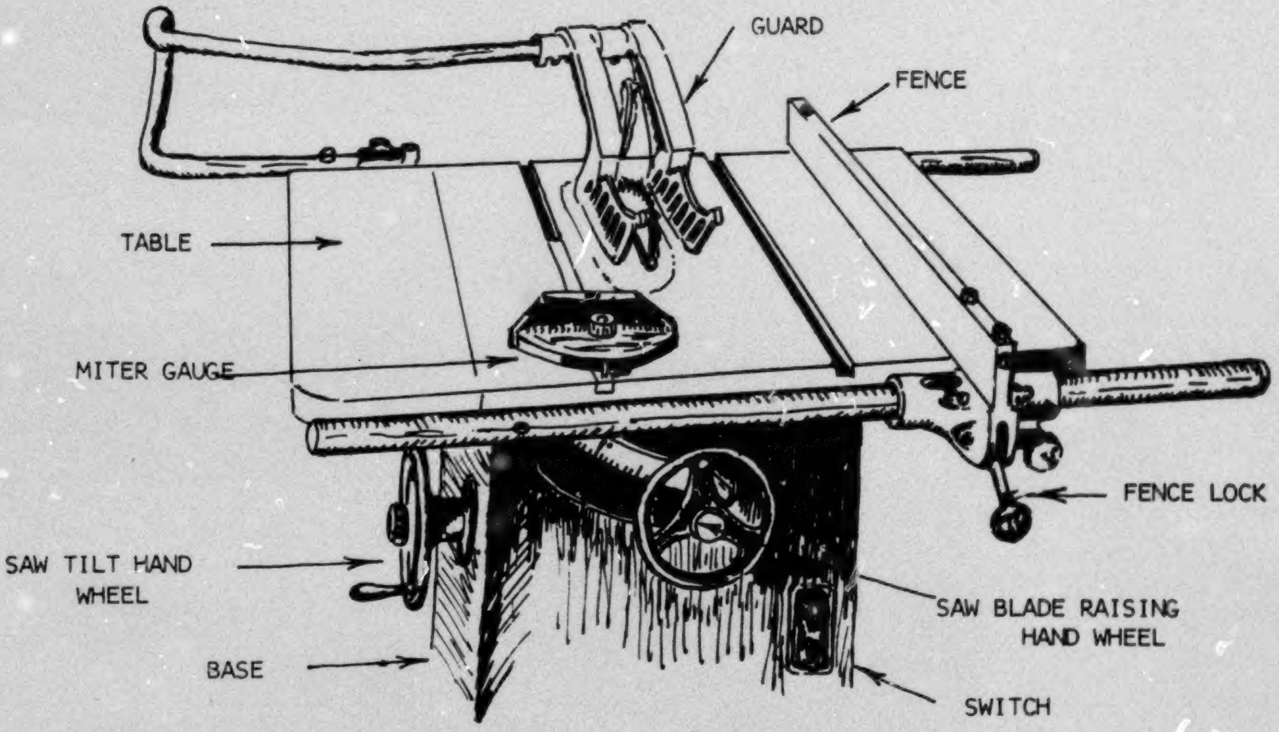


TABLE SAW

USES: RIPPING, CROSSCUT, CUTTING ANGLES AND COMPOUND ANGLES, DADO CUT, RABBET

SAFETY PROCEDURE:

ADJUSTMENTS ON THE MACHINE:

1. WHEN SETTING UP THE MACHINE FOR ANY SAWING JOB, SEE THAT THE SAW REVOLVES FREELY, THAT IT IS SECURELY FASTENED TO THE ARBOR, AND THAT THE SCREWS OR CLAMPS ON THE FENCES ARE TIGHTENED. THE SAW TABLE SHOULD ALSO BE FREE FROM TOOLS AND MATERIAL EXCEPT THE STOCK TO BE CUT.
2. USE THE SPLITTER GUARD, SAW GUARD AND A PUSH STICK OR ANY OTHER SAFETY DEVICES FOR ALL OPERATIONS WHERE THEY CAN BE USED.
3. KEEP THE SAWS SHARP AND PROPERLY SET. IT IS VERY DANGEROUS TO WORK WITH DULL AND INSUFFICIENTLY SET TOOLS.
4. ALWAYS STOP THE MACHINE BEFORE CHANGING ANY ADJUSTMENTS.
5. KEEP THE FLOOR AROUND THE MACHINE IN GOOD CONDITION, CLEAN AND FREE FROM SCRAPS, SAWDUST, OIL OR GREASE, SO THAT THERE WILL BE NO DANGER OF SLIPPING.
6. DO NOT LOOK AROUND OR CARRY ON A CONVERSATION WHEN OPERATING THE MACHINE, BUT GIVE IT YOUR UNDIVIDED AND UNINTERRUPTED ATTENTION.
7. STOCK TO BE SAWED MUST ALWAYS BE HELD AGAINST ONE OF THE FENCES. NEVER TRY TO SAW "FREEHAND" ; THAT IS, WITHOUT HOLDING THE STOCK AGAINST A FENCE. IT MUST HAVE A STRAIGHT, TRUE EDGE, AND LIE FLAT ON THE TABLE. STOCK "IN WIND" OR WITH ROUGH, UNEVEN EDGES SHOULD NOT BE WORKED ON THE CIRCULAR SAW.
8. THE SAW BLADE MUST NOT PROJECT MORE THAN 1/8" ABOVE ANY STOCK TO BE SAWED.

9. STAND TO ONE SIDE OF THE SAW, AND DO NOT ALLOW ANY OTHER PERSON TO STAND IN LINE WITH THE SAW BLADE.

10. DO NOT REACH OVER THE SAW. HAVE A HELPER OR "TAIL MAN" TO ASSIST IN HANDLING LONG OR BULKY MATERIAL.

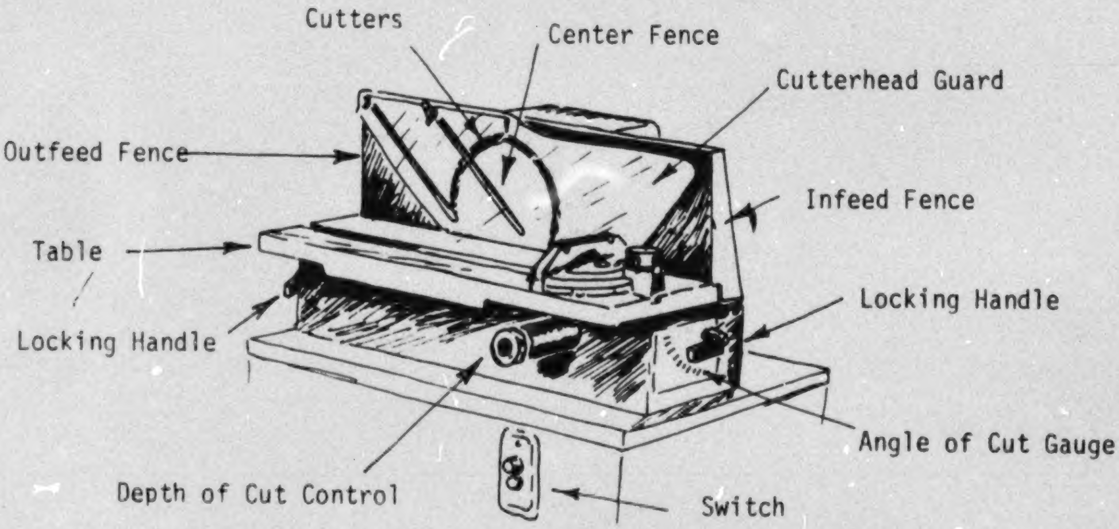
11. USE THE CLEARANCE BLOCK WHEN CROSSCUTTING SHORT PIECES. NEVER USE THE RIPPING FENCE AS A STOP WHEN CROSSCUTTING. IT MAY CAUSE A "KICKBACK".

12. ROLL UP YOUR SLEVES OR WEAR A SHOP COAT WITH TIGHT FITTING AND RATHER SHORT SLEEVES. TUCK IN YOUR NECKLINE AND DO NOT WEAR GLOVES. LOOSE FITTING, TORN, OR RAGGED CLOTHING IS DANGEROUS, BECAUSE IT MAY BE CAUGHT BY THE SAW AND THE OPERATOR'S HAND OR ARM PULLED AGAINST THE SAW BLADE AND SERIOUSLY INJURED.

13. AFTER TURNING OFF POWER, REMAIN AT MACHINE UNTIL BLADE COMES TO COMPLETE STOP. LOWER BLADE BELOW TABLE LEVEL.

OPERATING PROCEDURE:

1. SET UP SAW PROPERLY FOR THE JOB YOU ARE GOING TO PERFORM:
   - RIPPING - SET FENCE AT PROPER DISTANCE FROM RIP BLADE.
   - CROSSCUTTING - USE MITER GAUGE AND COMBINATION OR CROSSCUT BLADE.
   - ANGLES - SET MITER GAUGE OR ARBOR AT PROPER ANGLE TO THE COMBINATION BLADE OR TABLE.
2. PLACE GUARD IN PROPER POSITION.
3. SAW BLADE TEETH ALWAYS POINT TOWARD OPERATOR AND SHOULD EXTEND APPROXIMATELY 1/8" ABOVE MATERIAL TO BE CUT.
4. SECURE APPROVAL OF INSTRUCTOR BEFORE CONTINUING.
5. AFTER OBSERVING PROPER SAFETY PROCEDURES, TURN ON MACHINE.
6. PLACE MATERIAL ON TABLE AND FEED STEADILY INTO BLADE. USE EITHER THE FENCE OR MITER GAUGE. NO FREEHAND CUTTING.
7. KEEP A 4" MARGIN OF SAFETY FOR YOUR FINGERS. WHEN RIPPING CLOSER THAN 4" USE A PUSH STICK. WHEN CROSSCUTTING, USE A DIFFERENT MACHINE.
8. OBSERVE ALL SAFETY PROCEDURES.
9. WHEN RIPPING, ALWAYS PUSH THE MATERIAL ALL THE WAY PAST THE BLADE AND LET IT DROP UNLESS A HELPER IS OFFBEARING OR ASSISTING.
10. OPERATOR IS RESPONSIBLE TO INSTRUCT THE HELPER WHO IS AIDING IN THE MACHINE OPERATION.


Cutters
Center Fence
Cutterhead Guard
Outfeed Fence
Infeed Fence
Table
Locking Handle
Locking Handle
Angle of Cut Gauge
Depth of Cut Control
Switch

UNIPLANE

USES: PLANNING, JOINTING, CHAMFERING AND MANY MORE OPERATIONS.

SAFETY PROCEDURE:

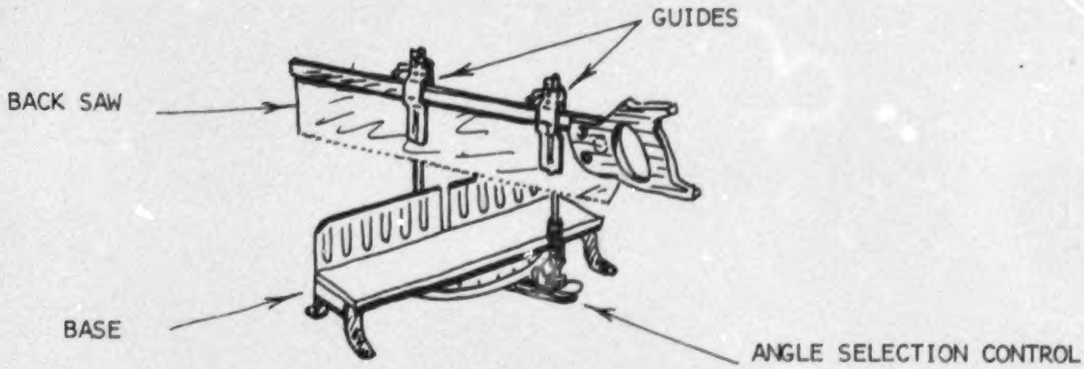
1. ALWAYS WEAR SAFETY GLASSES OR GOGGLES.
2. ALWAYS OBTAIN PERMISSION FROM INSTRUCTOR BEFORE USING UNIPLANE.
3. USE STOCK THAT IS FREE FROM KNOTS, SPLITS AND CHECKS.
4. SAFETY GUARDS SHOULD BE IN PLACE AND USED AT ALL TIMES.
5. STAND TO LEFT SIDE WHILE OPERATING MACHINE.
6. THE MAXIMUM DEPTH OF CUT ON THE UNIPLANE IS 1/16".
7. ALWAYS HOLD THE STOCK FIRMLY AGAINST THE FENCE AND TABLE.
8. STOCK MUST BE AT LEAST 4" LONG TO BE CUT ON THE UNIPLANE.
9. A "PUSH STICK" MUST BE USED ON STOCK LESS THAN 2" WIDE.
10. A "PUSH BOARD" MUST BE USED WHEN SURFACING STOCK.
11. ALWAYS USE THE MITER GAUGE WHEN CUTTING END GRAIN. FEED THE STOCK SLOWLY.
12. WHEN FINISHED, SHUT THE POWER OFF AND DO NOT LEAVE THE UNIPLANE UNTIL THE CUTTERHEAD HAS COME TO A COMPLETE STOP. CLEAN UP YOUR MESS.
13. ON SPECIAL TYPES OF OPERATIONS, MAKE SURE AN INSTRUCTOR IS PRESENT.

OPERATING PROCEDURE:

1. CHECK SQUARNESS OF FENCE TO TABLE. USE TRY-SQUARE.
2. SET INFEED FENCE FOR 1/16" DEPTH CUT OR LESS.
3. STAND TO LEFT SIDE, TURN ON UNIPLANE, AND ALLOW CUTTERHEAD TO COME TO FULL SPEED.
4. HOLD STOCK FIRMLY AGAINST INFEED FENCE AND START YOUR CUT.
5. CONTINUE PUSHING STOCK AGAINST CUTTERHEAD AT A UNIFORM AND MODERATE RATE OF SPEED, KEEPING STOCK SECURE AGAINST FENCE AND TABLE. PUSH STOCK PAST OUTFEED FENCE AND OFF TABLE.

UNIPLANE (CON'T)

6. REPEAT OPERATION UNTIL EDGE OR END IS STRAIGHT AND SMOOTH.
7. WHEN CUTTING END GRAIN, HOLD STOCK FIRMLY AGAINST MITER GAUGE AND PUSH AT SLOW SPEED.
8. WHEN WORK IS COMPLETED, TURN OFF UNIPLANE, REMAIN AT UNIPLANE UNTIL CUTTERHEADS HAVE STOPPED.

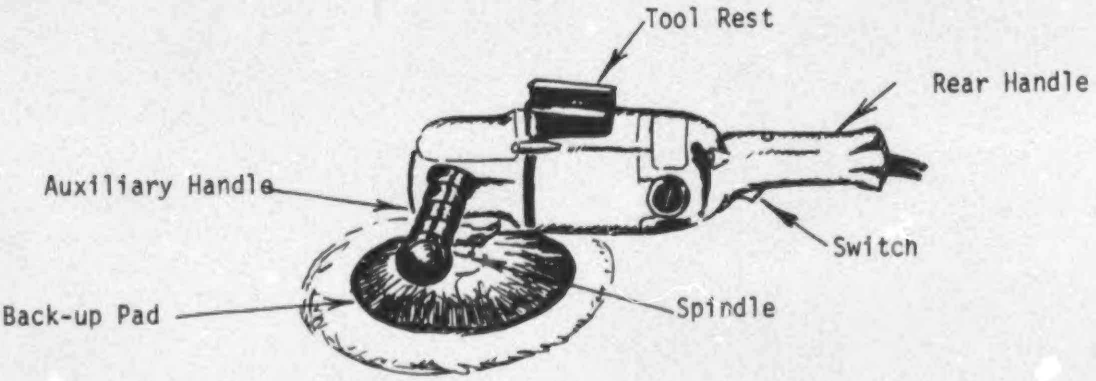


MITER BOX

USES: MAKING JOINTS BECAUSE OF ACCURACY AND CAN BE USED TO CUT ANY ANGLE.

OPERATING PROCEDURE:

1. SELECT ANGLE YOU WANT PUSHING UP LEVER AT BASE OF MITER BOX.
2. PLACE THE EDGE OF THE WOOD AGAINST THE SIDE OF THE BOX.
3. CAREFULLY LOWER THE BACK SAW DOWN ON THE STOCK TO BE CUT.
4. FOR ACCURATE WORK, CLAMP THE STOCK WITH A HAND SCREW OR "C" CLAMP.
5. USE LONG, EASH STROKES WHILE MAKING THE CUT.
6. REMOVE STOCK FROM MITER BOX AND CLEAN UP YOUR MESS.



SANDER - POLISHER

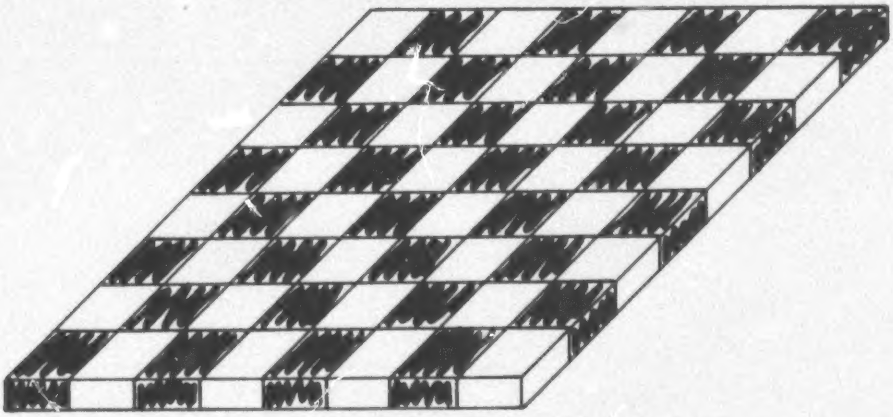
USES: SMOOTHING WELDS, SMOOTHING CASTINGS, SHAPING METAL AND WOOD PROJECTS, REMOVING RUST, SCALE AND PAINT, POLISHING

SAFETY PROCEDURES:

1. ALWAYS WEAR EYE PROTECTION AND GLOVES.
2. UNPLUG THE CORD WHEN CHANGING DISC.
3. SEE THAT NO ONE ELSE IS TOO CLOSE TO YOUR WORK.
4. STAND IN A SAFE, SECURE POSITION.
5. SMALL OBJECTS SHOULD BE FASTENED DOWN.

OPERATING PROCEDURE:

1. SECURE WORK PIECE.
2. START SANDER AND THEN LOWER TO WORK.
3. KEEP THE SANDING DISC AT A SLIGHT ANGLE TO THE WORK, AND LET THE WEIGHT OF THE MACHINE DO THE WORK.
4. KEEP THE SANDER MOVING TO AVOID LOW SPOTS.
5. REMOVE SANDING DISC FROM WORK BEFORE RELEASING TRIGGER SWITCH.
6. OPERATE AT HIGH SPEED FOR SANDING OR GRINDING AND AT LOW SPEED FOR POLISHING.



INSTRUCTION SHEET

PROCEDURE FOR CHESS OR CHECKER BOARD

APPROXIMATELY 2" SQUARES

1. CUT WOOD TO ROUGH SIZE (CROSSCUT SAW).
2. JOINT OR PLANE ONE EDGE STRAIGHT ON EACH PIECE.
3. RIP 4 STRIPS OF EACH COLOR WOOD APPROX. 2" WIDE. THEY MUST BE THE SAME SIZE. BEFORE EACH CUT, JOINT THE EDGE WHICH WILL BE AGAINST THE FENCE.
4. LAY ALTERNATE COLORS OUT ON TABLE TO CHECK EDGE FIT. IF THEY FIT, YOU ARE READY TO GLUE. IF THEY DO NOT FIT, YOU MUST PLANE OR JOINT THE EDGES UNTIL THEY FIT TOGETHER. ALL PIECES MUST BE THE SAME WIDTH.
5. APPLY WHITE GLUE TO EACH EDGE BEING PUT TOGETHER. CLAMP WITH AT LEAST THREE BAR CLAMPS. FIVE BAR CLAMPS WOULD BE BETTER. CLAMP ON ALTERNATED SIDES TO KEEP OUT WARP.
6. PLANE ONE SURFACE FLAT (COULD USE BELT SANDER).
7. CROSSCUT 8 PIECES 2" WIDE. THEY MUST BE THE SAME WIDTH AS THE PIECES WERE WHEN THEY WERE GLUED UP.
8. FIT THESE TOGETHER SO THEY ALTERNATE AND FORM A CHECKERBOARD DESIGN.
9. GLUE EACH EDGE AND CLAMP INTO PLACE AS BEFORE. DRY OVERNIGHT.
10. SAND OR PLANE SURFACE FLAT.
11. SQUARE UP THE EDGES.
12. FINISH SAND PROJECT.
13. FINISH AS DESIRED.

INFORMATION SHEET

EXPANDING POLYSTYRENE BEADS

EXPANDABLE BEADS CONSIST OF POLYSTYRENE PARTICLES WHICH CONTAIN FIVE TO EIGHT PERCENT BY WEIGHT OF A VOLATILE SATURATED PARAFFINIC HYDROCARBON. THIS HYDROCARBON SERVES AS A BLOWING AGENT AND THE APPLICATION OF HEAT CAUSES THE BEADS TO FOAM OR EXPAND. ACTUAL EXPANSION IS BETWEEN TWO AN- FIFTY TIMES THE VOLUME OF THE UNEXPANDED BEADS.

FOUR METHODS OF EXPANDING BEADS:

HOT WATER, STEAM, HOT AIR, RADIANT HEAT

1. HOT WATER METHOD - BOIL 4" OF WATER IN A PAN AND PLACE VIRGIN BEADS IN THE BOILING WATER. SKIM BEADS OFF AS THEY RISE TO THE SURFACE EXPANDED.
2. STEAM METHOD - PLACE VIRGIN BEADS IN AN AUTOCLAVE. UNDER THESE CONDITIONS, THE WATER TURNS TO STEAM AND PRESSURE IS CREATED WITHIN THE AUTOCLAVE. EXPANSION TAKES PLACE AND THE BEADS EXPAND UP TO FIFTY TIMES THEIR ORIGINAL SIZE.
3. HOT AIR - PLACE VIRGIN BEADS IN A FIVE GALLON CAN WITH A LID. PLACE HEAT GUN NOZZLE THROUGH THE LID AND THE HOT AIR WHICH CIRCULATES WITHIN THE CAN EXPANDS THE VIRGIN BEADS.
4. RADIANT HEAT - PLACE VIRGIN BEADS IN AN AREA WHERE THE HEAT PATH CROSSES THROUGH. THE RADIANT HEAT WILL EXPAND THE UNEXPANDED BEADS.

HOW DO THE BEADS EXPAND?

THE BEADS EXHIBIT SOME PLASTIC FLOW ABOVE 200° AND THE SURFACE OF THE BEADS BECOME SOFT ENOUGH TO ADHERE TO EACH OTHER. CELLS BEGIN TO FORM WHEN THE STRONG INTERNAL VAPOR PRESSURE OF THE CONTAINED BLOWING AGENT EXPANDS THE PARTICLES. AVOID USING METAL SPOONS TO DISPENSE MATERIAL AND AVOID THE PACKAGES OF BEADS NEAR THE OVEN AREA.

APPENDIX E

TEAM TEACHING MATERIAL

INCLUDED IN THIS APPENDIX TO THE GUIDE ARE BY-LAWS FOR FORMING A TEACHING TEAM AND PROCEDURES FOR HOLDING TEAM MEETINGS. THE TEACHING TEAMS AT BEND AND ALBANY USED THESE BY-LAWS AS A SUGGESTION IN WRITING UP THEIR OWN TEAM BY-LAWS OR TEAM ORGANIZATION. TEACHING TEAMS AT BOTH SITES FOLLOW THE PROCEDURES FOR TEAM MEETINGS AT THEIR WEEKLY TEAM MEETINGS.

SUGGESTED BYLAWS FOR A TEACHING TEAM:

1. TASK LEADER

1.1 EACH TEAM WILL HAVE A TASK LEADER.

1.2 THE POSITION OF THE TASK LEADER WILL BE ROTATED AMONG ALL THE MEMBERS OF THE TEAM.

1.3 THE BUILDING PRINCIPAL WILL BE TASK LEADER FOR THE TOTAL TEAM. WHENEVER THE GROUP CHOOSES, THEY MAY APPOINT ANY MEMBER OF THE TOTAL TEAM AS THEIR TASK LEADER.

1.4 TASK LEADERS WILL NOT RECEIVE REMUNERATION, RELEASED TIME, OR SPECIAL CONSIDERATION BY THE ADMINISTRATION.

1.5 THE ADMINISTRATION WILL ESTABLISH AND RESPECT THOSE RELATIONSHIPS WITH THE TASK LEADER WHICH ARE IDENTIFIED IN THE TEAM AGREEMENTS.

1.6 DUTIES, AUTHORITY AND RESPONSIBILITIES OF THE TASK LEADER WILL BE IDENTIFIED IN THE TEAM AGREEMENTS.

2. RECORDER

2.1 EACH TEAM WILL HAVE A RECORDER.

2.2 RECORDERS WILL BE RESPONSIBLE FOR WRITING MINUTES OF THE DECISIONS MADE AT TEAM MEETINGS.

2.3 OTHER DUTIES AND RESPONSIBILITIES OF THE RECORDER WILL BE IDENTIFIED IN THE TEAM AGREEMENTS.

3. AGENDA

3.1 AN AGENDA WILL BE PUBLISHED AND DISTRIBUTED TO TEAM MEMBERS PRIOR TO EACH MEETING. SUFFICIENT ADVANCE TIME MUST BE ALLOWED TO ENABLE MEMBERS TO READ AND CONSIDER AGENDA TOPICS.

3.2 ALL AGENDA TOPICS REQUIRING DECISIONS WILL BE WRITTEN IN THE ADOPTED DECISION-MAKING FORM.

3.3 COPIES OF AGENDAS WILL BE DISTRIBUTED TO EACH TEAM MEMBER.

3.4 COPIES OF AGENDAS WILL NOT BE SENT TO OTHER PERSONNEL UNLESS APPROVED BY THE TEAM.

3.5 TEAM AGREEMENTS WILL SPECIFY FORMAT AND EXPLICIT GROUND RULES FOR THE CONSTRUCTION AND USE OF AGENDAS.

4. MINUTES

4.1 MINUTES WILL BE PUBLISHED SOON AFTER EACH TEAM MEETING.

4.2 MINUTES SHALL RECORD EACH DECISION MADE BY THE TEAM. REPORTS OF DISCUSSION WILL BE CLEARLY IDENTIFIED SO THEY CANNOT BE

MISINTERPRETED AS DECISIONS. IF THE RECORDER PROVIDES INTERPRETIVE OR CLARIFYING COMMENTS THEY MUST BE CLEARLY IDENTIFIED AS EDITORIAL COMMENTS.

4.3 COPIES OF SUB-TEAM MINUTES WILL BE DISTRIBUTED TO OTHER DISTRICT PERSONNEL AS APPROVED BY THE SUB-TEAM.

4.4 FORMAT OF THE TEAM MINUTES SHALL BE PATTERNED AFTER THE AGENDA FORMAT.

5. TEAM MEETINGS

5.1 TEAM MEETINGS SHALL BE HELD ON A REGULAR WEEKLY SCHEDULE.

5.2 ALL TEAM MEMBERS SHALL BE PRESENT AT OFFICIAL TEAM MEETINGS. MEMBERS WILL PLACE A HIGH PRIORITY ON ATTENDANCE AND AVOIDANCE OF CONFLICTS.

5.3 TEAMS MAY SCHEDULE "CHALKBOARD" OR " DOORWAY" OR SUPPLEMENTAL MEETINGS AS DESIRED AT THEIR DISCRETION. THE MEETINGS ARE IDENTIFIED AS SUPPLEMENTAL BUT ARE NOT TO REPLACE THE REGULAR MEETING.

5.4 REGULAR MEETINGS MAY BE CANCELLED OR POSTPONED BY CONSENSUS AGREEMENT.

5.5 EACH MEMBER IS RESPONSIBLE TO USE APPROPRIATE COMMUNICATIONS SKILLS UNTIL IT IS ASCERTAINED THERE IS A COMMON UNDERSTANDING ON DECISIONS.

5.6 EACH TEAM MEMBER WILL DEVELOP THE INTERPERSONAL COMMUNICATION SKILLS IDENTIFIED IN THE TEAM AGREEMENTS AND USE THEM EFFECTIVELY DURING MEETINGS.

5.7 TEAM MEETINGS ARE TO MAINTAIN TASK ORIENTATION AS TOP PRIORITY.

6. FOLLOW-UP RESPONSIBILITIES AFTER EACH MEETING

6.1 EACH TEAM MEMBER WILL READ THE TEAM MINUTES SOON AFTER DISTRIBUTION.

6.2 NOTATIONS REGARDING NEEDED CORRECTIONS WILL BE MADE ON THE MINUTES FOR PRESENTATION AT THE NEXT MEETING.

6.3 EACH MEMBER WILL INITIATE THE NECESSARY ACTION TO IMPLEMENT DECISIONS.

6.4 DECISIONS MADE DURING TEAM MEETINGS WILL NOT BE MODIFIED OR CHANGED IN ANY WAY WITHOUT CONSENSUS OF ALL TEAM MEMBERS.

6.5 TEAM MEMBERS WILL SUBMIT AGENDA TOPICS FOR THE NEXT MEETING.

7. TEAM SELF-EVALUATION PROCEDURES

7.1 TEAM MEMBERS WILL REGULARLY AND OPENLY IDENTIFY PROCESS INTERRUPTIONS OF MEETING PROGRESS (I.E., FLIGHT, PAIRING, MISUNDERSTANDING, VIOLATION OF AGREEMENTS, PLOPS, FEELINGS, ETC.)

7.2 PROCESS INTERRUPTIONS WILL BE GIVEN PRIORITY FOR SOLUTION OVER THE CONTENT TOPICS.

7.3 TEAMS WILL REGULARLY IDENTIFY NEEDED CHANGES IN THEIR AGREEMENTS.

7.4 TEAMS WILL REGULARLY EVALUATE THE EFFICIENCY AND QUALITY OF THEIR OPERATION.

7.5 EVALUATIONS OF TEAM OPERATION AND PRODUCT WILL ALWAYS USE THE CRITERION OF " CONTRIBUTION TO AN IMPROVED INSTRUCTIONAL PROGRAM FOR CHILDREN" AS ITS FIRST CONCERNS.

SUGGESTED PROCEDURE FOR TEAM MEETING

1. INFORMATIONAL AND ADMINISTRATIVE TOPICS WILL BE REVIEWED FOR QUESTIONS OR NEEDED CLARIFICATION.

2. MINUTES OF THE LAST MEETING WILL BE APPROVED AS PUBLISHED.

3. CHANGES IN THE ORDER OF DECISION-MAKING TOPICS, IF NEEDED, WILL BE DECIDED BY TEAM MEMBERS.

4. ALL AGENDA TOPICS WHICH REQUIRE BRIEF CONSIDERATION OR LITTLE DISCUSSION WILL BE LISTED FIRST SO THEY CAN BE DIRECTED UPON RAPIDLY. TASK LEADERS DECISION.

5. ALL OTHER TOPICS WILL BE PLACED IN A PRIORITY ORDER. THOSE MOST IMPORTANT BECAUSE OF TIME CONSTRAINTS, CHILDREN'S NEEDS, ADMINISTRATIVE REQUIREMENTS OR OTHER SIGNIFICANT CRITERIA WILL BE LISTED FIRST. TASK LEADER DECISION.

6. ALL AGENDA TOPICS WILL BE WRITTEN IN DECISION-MAKING FORM. THAT IS, THEY WILL BE WRITTEN AS IF THE DECISION WERE ALREADY MADE. EACH TOPIC WILL INCLUDE THE SPECIFIC DETAILS (WHO, WHAT, WHEN, WHERE, HOW) NECESSARY FOR THE DECISION.

7. WHEN AN OPEN DISCUSSION IS DESIRED, TIME LIMITS WILL BE SET FOR THE TOPICS, BY TEAM CONSENSUS.

8. AGENDA TOPICS WHICH REQUIRE LENGTHY PROPOSALS SHOULD BE DISTRIBUTED TO TEAM MATES AT LEAST ONE WEEK IN ADVANCE FOR THEIR CONSIDERATION.

9. ALL TEAM MEMBERS ARE RESPONSIBLE FOR SUBMITTING AGENDA TOPICS FOR EACH MEETING.

10. DURING THE TEAM MEETING PROGRESS IS MADE THROUGH THE ORDER OF THE AGENDA. WHEN THE TIME LIMIT FOR A MEETING IS REACHED THE TEAM STOPS, REMAINING AGENDA TOPICS ARE INCLUDED IN THE NEXT MEETING AT THE TOP OF THE LIST.

11. DECISION-MAKING TOPICS CANNOT BE DROPPED FROM A TEAM AGENDA WITHOUT A TEAM DECISION.

12. TEAMS MAY DECIDE TO STOP SEQUENTIAL PROGRESS ON AGENDA TOPICS JUST BEFORE THE END OF A MEETING AND CHOOSE TO GO OUT-OF-ORDER SELECTING A PRIORITY TOPIC FROM THE REMAINING TOPICS.

13. IF A TEAM CHOOSES AGENDA TOPIC CONTRIBUTORS MAY REMAIN ANONYMOUS.

14. ALL AGENDA TOPICS BECOME THE PROPERTY OF THE TEAM. THEY ARE IDENTIFIED AS SUCH AND CANNOT BE CHANGED WITHOUT TEAM ACTION.

15. ONCE A TEAM DECISION IS MADE ALL MEMBERS ARE RESPONSIBLE FOR ITS IMPLEMENTATION. DECISIONS CAN BE CHANGED ONLY BY THE TOTAL TEAM.

CAREER EXPLORATION/INDUSTRIAL ARTS (STUDENT MANAGED LEARNING)

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_______ Completely
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Would you recommend this publication to another district?

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_______ Always no
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_______ Very easy to use
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